KALIBURN™

ProLine 2150 Precision Plasma Cutting System

Revision M
10/15/2012

Manual Part Number 718082

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REVISION
M

Revision History

Rev	ECO#	Author	Date	Description of Change
0	-	-	-	As released
1	-	-	10/05/05	• Cut chart update
2	-	-	-	-
3	-		10/26/05	• Cut chart update
4	-		11/18/05	• Parts list update
A	-		12/12/05	• Cut chart update • Parts list update
B	-		01/18/06	• Added ISO spec and flashback arrestors to gas console specifications. • Corrected 220/240V coolant flow solenoid part number.
C	-		03/02/06	• Changed to 24VDC Condor power supply for gas valves.
D	-		6/13/06	• Changed inductor/resistor CTP sensor lead filter inside RHF box to the ferrite core filter. • Added 2nd control transformer fuse and labeled the fuses F1A and F1B.
E			7/27/06	• Cut chart updates
F			05/09/07	• Changed coolant level switch location • Removed PAR, changed CR3 • Cut chart updates • Corrected regulator and gauge PN's for hydrogen manifold assembly
G			05/23/07	• Cut chart updates
J			10/15/07	• Added PAR relay in series with surge injection circuit to schematic and parts list • Cut chart updates
K			10/25/2010	SECTIONS UPDATES Contents Section 2 Section 3 Section 4 Section 5 Section 6 Appendix A Appendix B - Deleted

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Rev	ECO#	Author	Date	Description of Change
L			08/01/2012	Section 1, added references to Section 5. Section 5, added chopper warning.
M			10/15/2012	Added Quick-Disconnect Torch information throughout manual. Section 5, defective flow switch (25 blinks).

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Limited Warranty

KALIBURN expressly warrants that this product shall be free from defects in materials and workmanship, under proper and normal use for the intended function of such equipment, for a period of one (1) year for the ProLine 2150 torch and leads and three (3) years for the ProLine 2150 power supply and gas console. This product is intended for commercial use and is not intended for personal, family, or household purposes. There are no warranties that extend beyond the description on the face hereof. **All other warranties, either expressed or implied, including any implied warranty of merchantability or fitness for any particular purpose, are expressly excluded.**

If this product or any component thereof is determined to be defective in manufacture, KALIBURN will repair or replace the defective component or product. The buyer's remedies are limited to the return of the product for repair or replacement of any non-conforming product or part at the sole discretion of KALIBURN. No freight charges of any kind are covered under this warranty. All returned goods shall be at the buyer's risk and expense. Beyond this remedy, KALIBURN will not be responsible for any special, incidental or consequential damages or injury to the person or property of anyone by reason of any defect in any equipment sold hereunder.

This warranty will be considered void if torches or torch consumables manufactured by anyone other than KALIBURN are incorporated into this product.

Returned Goods Procedure

KALIBURN utilizes a returned goods procedure that must be followed before returning any items for repair, replacement, or restocking. This means that a returned goods authorization number must be obtained prior to shipment to KALIBURN. It will be necessary for the customer to provide a description, along with the stock number and serial number, if applicable, of the item to be returned. In no case will KALIBURN accept a returned shipment without the proper returned goods authorization number.

Electromagnetic Compatibility (EMC)

The 380V 50/60Hz and 415V 50/60Hz CE Marked ProLine 2150 plasma cutting systems are manufactured to comply with the European standards EN 60974-10 (Electromagnetic compatibility (EMC) – Product standard for arc welding equipment). Information about the EMC standard EN 60974-10 can be found in Appendix A.

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TABLE OF CONTENTS

Section 1 Safety 1-1
General Precautions 1-1
Ultraviolet Radiation Protection 1-1
Noise Protection 1-1
Toxic Fume Prevention 1-1
Electric Shock Prevention 1-2
Fire Prevention 1-3
Explosion Prevention 1-3
Health Support Equipment 1-4
Safety Standards Booklet Index 1-4

Section 2 Specifications 2-1
System Description 2-1
System Components 2-2
Power Supply Specifications 2-2
Gas Console Specifications 2-4
Remote High Frequency Console Specifications 2-5
Torch Specifications 2-6
Remote On/Off Control Specifications (Optional) 2-7
Hydrogen Manifold Specifications (Optional) 2-8
Airborne Noise Emissions 2-9

Section 3 Installation 3-1
Initial Inspection 3-1
System Interconnection 3-1
Power Supply Installation 3-2
Remote High Frequency Installation 3-2
Torch Installation 3-2
Primary Power Connection 3-2
Power Supply Output Connections 3-4
RHF Console Ground Connection 3-5
Torch Leads to RHF Console Connections 3-7
Torch Connections 3-9
Torch Head Connection 3-12
Gas Console Input Connections 3-13
Gas Console Output Connections 3-14
CNC Machine Interface Connections 3-15
Torch Coolant Requirements 3-16
Initial Filling of the Torch Coolant Reservoir 3-17
Optional Remote On/Off Control Installation 3-18
Optional Hydrogen Manifold Installation 3-18

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Section 4 Operation 4-1
Power Supply Front Panel Controls 4-1
Optional Hydrogen Manifold Controls 4-3
Setting up a Cut 4-4
Gas Purge 4-5
Making a Cut 4-6
Consumable Life 4-6
Cut Quality 4-7
Cutting Charts 4-8

Section 5 Maintenance and Troubleshooting 5-1
Routine Maintenance 5-1
Replacing the Torch Coolant 5-3
Microprocessor Status LED's 5-4
Microprocessor Sequence of Operation 5-5
Troubleshooting Using the Control Panel Status LED's 5-6
Troubleshooting Using the Microprocessor Error LED 5-7
General Troubleshooting 5-8
Chopper Test Procedure 5-10

Section 6 Parts List 6-1
Power Supply 6-1
Remote High Frequency Console 6-7
Torch and Torch Valve Assembly 6-9
Shielded Torch Leads 6-10
Gas Hose Package 6-11
Coolant and Power Leads 6-12
Work Ground Cable 6-13
Torch Consumables - Mild Steel Cutting, Copper Electrode 6-14
Torch Consumables - Stainless Steel Cutting (Air Plasma), Copper Electrode 6-15
Torch Consumables - Stainless Steel Cutting (H17 Plasma), Copper Electrode 6-16
Torch Consumables - Aluminum Cutting, Copper Electrode 6-17
Torch Consumables - Marking, Copper Electrode 6-18
Gas Console Without Integrated Inova 6-19
Gas Console With Integrated Inova 6-20
Power Supply Microprocessor P.C. Board 6-23
A.C. Detect P.C. Board 6-24
Power Supply Relay P.C. Board 6-25
Power Supply I/O P.C. Board 6-26
Gas Console Relay P.C. Board 6-27
Remote On/Off Control Assembly (Optional) 6-28
Remote On/Off Control Cable (Optional) 6-29
Hydrogen Manifold Assembly (Optional) 6-30
Hydrogen Manifold Interface Cable (Optional) 6-31
Consumable Spare Parts Kit 6-32

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Appendix A Electromagnetic Compatibility (EMC) A-1

Background A-1
Installation and Use A-1
Assessment of Area A-2
Methods of Reducing Emissions A-2

Illustrations

Figure 2-1 Power Supply Dimensions 2-3
Figure 2-2 Remote High Frequency Console Mounting Dimensions 2-5
Figure 2-3 Torch Dimensions 2-6
Figure 2-4 Remote On/Off Control Dimensions (Optional) 2-7
Figure 2-5 Hydrogen Manifold Dimensions (Optional) 2-8
Figure 3-1 System Interconnection Diagram 3-1
Figure 3-2 Primary Power Connections 3-3
Figure 3-3 Power Supply Output Connections 3-6
Figure 3-4 Torch Leads to RHF Console Connections 3-8
Figure 3-5 Torch Connections 3-11
Figure 3-6 Gas Console Input Connections 3-12
Figure 3-7 Gas Console Output Connections 3-13
Figure 3-8 Freezing Points of Aqueous Propylene Glycol Solutions 3-15
Figure 4-1 Front Panel Controls 4-1
Figure 4-2 Hydrogen Manifold Controls (Optional) 4-3
Figure 5-1 Chopper Diagnostics - Part 1 5-11
Figure 5-2 Chopper Diagnostics - Part 2 5-12
Figure 6-1 Power Supply Front View 6-3
Figure 6-2 Power Supply Rear View 6-4
Figure 6-3 Power Supply Left Side View 6-5
Figure 6-4 Power Supply Right Side View 6-6
Figure 6-5 Remote High Frequency Console 6-8
Figure 6-6 Torch and Torch Valve Assembly 6-9
Figure 6-7 Shielded Torch Leads 6-10
Figure 6-8 Gas Hose Package 6-11
Figure 6-9 Coolant and Power Leads 6-12
Figure 6-10 Work Ground Cable 6-13
Figure 6-11 Torch Consumables - Mild Steel Cutting, Copper Electrode 6-14
Figure 6-12 Torch Consumables - Stainless Steel Cutting (Air), Copper Electrode 6-15
Figure 6-13 Torch Consumables - Stainless Steel Cutting (H17), Copper Electrode 6-16
Figure 6-14 Torch Consumables - Aluminum Cutting, Copper Electrode 6-17
Figure 6-15 Torch Consumables – Marking, Copper Electrode 6-18
Figure 6-16 Gas Console - Exterior 6-21
Figure 6-17 Gas Console - Interior 6-22
Figure 6-18 Power Supply Microprocessor P.C. Board 6-23
Figure 6-19 A.C. Detect P.C. Board 6-24
Figure 6-20 Power Supply Relay P.C. Board 6-25
Figure 6-21 Power Supply I/O P.C. Board 6-26

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Figure 6-22 Gas Console Relay P.C. Board 6-27
Figure 6-23 Remote On/Off Control Assembly (Optional) 6-28
Figure 6-24 Remote On/Off Control Cable (Optional) 6-29
Figure 6-25 Hydrogen Manifold Assembly (Optional) 6-30
Figure 6-26 Hydrogen Manifold Interface Cable (Optional) 6-31

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Section 1 Safety

General Precautions

Whereas plasma cutting has been used safely for years, it does require certain precautions to ensure the safety of the operator and other people around the equipment. It is management's responsibility to see that the following safety information is provided to each person who will operate, observe, perform maintenance, or work in close proximity to this piece of equipment.

Installation, as well as repairs, made to the ProLine 2150 system should only be performed by qualified personnel. The ProLine system makes use of both A.C. and D.C. circuitry for operation. **Fatal shock hazard does exist. Exercise extreme caution while working on the system**.

Ultraviolet Radiation Protection

Plasma cutting produces ultraviolet radiation similar to a welding arc. This ultraviolet radiation can cause skin and eye burns. For this reason, it is essential that proper protection be worn. The eyes are best protected by using safety glasses or a welding helmet with an AWS No. 12 shade or ISO 4850 No. 13 shade, which provides protection up to 400 amperes. All exposed skin areas should be covered with flame-retardant clothing. The cutting area should also be prepared in such a way that ultraviolet light does not reflect. Walls and other surfaces should be painted with dark colors to reduce reflected light. Protective screens or curtains should be installed to protect additional workers in the area from ultraviolet radiation.

Noise Protection

The ProLine 2150 system generates high noise levels while cutting. Depending on the size of the cutting area, distance from the cutting torch, and arc current cutting level, acceptable noise levels may be exceeded. Proper ear protection should be used as defined by local or national codes. See Section 2 for noise emission levels.

Toxic Fume Prevention

Care should be taken to ensure adequate ventilation in the cutting area. Some materials give off toxic fumes that can be harmful or fatal to people in the vicinity of the cutting area. Also, some solvents decompose and form harmful gases when exposed to ultraviolet radiation. These solvents should be removed from the area prior to cutting.
Galvanized metal can produce harmful gases during the cutting process. Ensure proper ventilation and use breathing equipment when cutting these materials.
Certain metals coated with or containing lead, cadmium, zinc, beryllium, and mercury produce harmful toxins. Do not cut these metals unless all people subjected to the fumes wear proper air breathing equipment.

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Electric Shock Prevention

The ProLine 2150 system uses high open circuit voltages that can be fatal. Extreme care should be used when operating or performing maintenance on the system. Only qualified personnel should service the ProLine system. Observe the following guidelines to protect against electric shock:

- A wall-mounted disconnect should be installed and fused according to local and national electrical codes. The disconnect should be located as close as possible to the power supply so it can be turned off in case of an emergency.
- The primary power cord should have a 600 volt minimum rating in order to protect the operator. In addition, it should be sized according to local and national electrical codes. Inspect the primary power cord frequently. Never operate the ProLine system if the power cord is damaged in any way.
- Make sure the primary power ground wire is connected to the input power ground stud on the ProLine power supply. Make sure the connection is securely tightened.
- Make sure the positive output (work ground) of the ProLine power supply is connected to a bare metal area on the cutting table. A driven ground rod should be placed no further than five feet from this connection. Make sure this ground point on the cutting table is used as the star ground point for all other ground connections.
- Inspect the torch leads frequently. Never use the system if the leads are damaged in any way.
- Do not stand in wet, damp areas when operating or performing maintenance on the system.
- Wear insulated gloves and shoes while operating or performing maintenance on the system.
- Make sure the ProLine system is switched off at the wall disconnect before servicing the power supply or torch.
- Never change torch consumable parts unless the ProLine system is switched off at the wall disconnect.
- Do not attempt to remove any parts from beneath the torch when cutting. Remember that the workpiece forms the current path back to the power supply.
- Never bypass the safety interlock devices.
- Before removing any of the ProLine covers, switch the system off at the wall disconnect. Wait at least five (5) minutes before removing any cover. This will give the capacitors inside the unit time to discharge. See Section 5 for additional safety precautions.
- Never operate the ProLine system without all of the covers in place. See Section 5 for additional safety precautions.
- Preventive maintenance should be performed daily to avoid possible safety hazards.

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Fire Prevention

When using the ProLine 2150 system, it is necessary to exercise good judgment. While cutting, the arc produces sparks that could cause a fire should they fall on flammable material. Make sure that all flammable material, such as paper, cloth, etc., is a suitable distance away from the cutting area. All flammable liquids should be at least 40 feet away from the cutting area, preferably stored in a metal cabinet. Plasma cutting should never be attempted on containers that contain flammable materials. Make sure that fire extinguishers are readily accessible in the cutting area.

Note: Make sure that the cutting area is properly ventilated when using oxygen as a cutting gas.

Explosion Prevention

The ProLine 2150 system uses compressed gases. Use proper techniques when handling compressed gas cylinders and other compressed gas equipment. Observe the following guidelines to protect against explosion:

- Never operate the ProLine system in the presence of explosive gases or other explosive materials.
- Never cut pressurized cylinders or any closed container.
- When using a water table and cutting aluminum under water or with water touching the underside of the aluminum plate, hydrogen gas is produced. This hydrogen gas may collect under the plate and explode during the cutting process. Make sure the water table is properly aerated to help prevent the accumulation of hydrogen gas.
- Handle all gas cylinders in accordance with safety standards published by the U.S. Compressed Gas Association (CGA), American Welding Society (AWS), Canadian Standards Association (CSA), or other local or national codes.
- Compressed gas cylinders should be maintained properly. Never attempt to use a cylinder that is leaking, cracked, or has other signs of physical damage.
- All gas cylinders should be secured to a wall or rack to prevent accidental knock over.
- If a compressed gas cylinder is not being used, replace the protective valve cover.
- Never attempt to repair compressed gas cylinders.
- Keep compressed gas cylinders away from intense heat, sparks, or flames.
- Clear the compressed gas cylinder connection point by opening the valve momentarily prior to installing a regulator.
- Never lubricate compressed gas cylinder valves or pressure regulators with any type of oil or grease.
- Never use a compressed gas cylinder or pressure regulator for any purpose other than which it is intended.
- Never use a pressure regulator for any gas other than which it is intended.
- Never use a pressure regulator that is leaking or has other signs of physical damage.
- Never use oxygen hoses and pressure regulators for any gas other than oxygen.
- Never use any gas hose that is leaking or has other signs of physical damage.

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Health Support Equipment

The ProLine 2150 system creates electric and magnetic fields that may interfere with certain types of health support equipment, such as pacemakers. Any person who uses a pacemaker or similar item should consult a doctor before operating, observing, maintaining, or servicing the ProLine system. Observe the following guidelines to minimize exposure to these electric and magnetic fields:

- Stay as far away from the ProLine power supply, torch, torch leads, and remote high frequency console as possible.
- Route the torch leads as close as possible to the work ground cable.
- Never place your body between the torch leads and work ground cable. Keep the work ground cable and the torch leads on the same side of your body.
- Never stand in the center of a coiled up set of torch leads or work ground cable.

Safety Standards Booklet Index

For further information concerning safety practices to be exercised with plasma arc cutting equipment, please refer to the following publications:

1. AWS Standard AWN, *Arc Welding and Cutting Noise*, obtainable from the American Welding Society, 550 NW LeJeune Road, Miami, FL 33126.
2. AWS Standard C5.2, *Recommended Practices for Plasma Arc Cutting*, obtainable from the American Welding Society, 550 NW LeJeune Road, Miami, FL 33126.
3. AWS Standard FSW, *Fire Safety in Welding and Cutting*, obtainable from the American Welding Society, 550 NW LeJeune Road, Miami, FL 33126.
4. AWS Standard F4.1, Recommended *Safe Practices for Preparation for Welding and Cutting of Containers and Piping*, obtainable from the American Welding Society, 550 NW LeJeune Road, Miami, FL 33126.
5. AWS Standard ULR, *Ultraviolet Reflectance of Paint*, obtainable from the American Welding Society, 550 NW LeJeune Road, Miami, FL 33126.
6. AWS / ANSI Standard Z49.1, *Safety in Welding, Cutting, and Allied Processes,* obtainable from the American Welding Society, 550 NW LeJeune Road, Miami, FL 33126.
7. ANSI Standard Z41.1, *Standard For Men's Safety-Toe Footwear*, obtainable from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.
8. ANSI Standard Z49.2, *Fire Prevention in the Use of Cutting and Welding Processes*, obtainable from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.
9. ANSI Standard Z87.1, *Safe Practices For Occupation and Educational Eye and Face Protection,* obtainable from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.

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10. ANSI Standard Z88.2, *Respiratory Protection*, obtainable from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.
11. OSHA Standard 29CFR 1910.252, *Safety and Health Standards,* obtainable from the U.S. Government Printing Office, Washington, D.C. 20402.
12. NFPA Standard 51, *Oxygen - Fuel Gas Systems for Welding, Cutting, and Allied Processes*, obtainable from the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269.
13. NFPA Standard 51B, *Cutting and Welding Processes*, obtainable from the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269.
14. NFPA Standard 70, *National Electrical Code*, obtainable from the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269.
15. CGA booklet P-1, *Safe Handling of Compressed Gases in Containers*, obtainable from the Compressed Gas Association, 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202.
16. CGA booklet P-14, *Accident Prevention in Oxygen-Rich and Oxygen-Deficient Atmospheres*, obtainable from the Compressed Gas Association, 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202.
17. CGA booklet TB-3, *Hose Line Flashback Arrestors*, obtainable from the Compressed Gas Association, 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202.
18. CSA Standard W117.2, *Safety in Welding, Cutting, and Allied Processes*, obtainable from Canadian Standards Association, 178 Rexdale Boulevard, Toronto, Ontario M9W lR3, Canada.
19. Canadian Electrical Code Part 1, *Safety Standard for Electrical Installations,* obtainable from the Canadian Standards Association, 178 Rexdale Boulevard, Toronto, Ontario M9W 1R3, Canada.

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Section 2 Specifications

System Description

The ProLine 2150 is a microprocessor controlled, 150 amp, 100% duty cycle high current density plasma cutting and marking system. It utilizes a precision, dual gas torch that is capable of cutting mild steel from gauge to 1-1/2" thick and stainless steel from gauge to 1" thick. The maximum piercing capacity is 1" thick material. The ProLine 2150 is equipped with a manually operated gas console with pressure readouts for all gases. All gas inlets and outlets are connected to the rear of the gas console. For excellent cut quality on mild steel, the ProLine 2150 uses oxygen for the plasma gas and either oxygen or air for the shielding gas. When cutting stainless steel or other non-ferrous materials, either air or H17 (17.5% hydrogen, 32.5% argon, 50% nitrogen) is used for the plasma gas and either air or nitrogen is used for the shielding gas. Air or nitrogen is used for the preflow and postflow gases. When cost is of greater concern than cut quality, the system can be configured to use clean, dry, oil-free shop air for all gas types.

The ProLine 2150 is technologically advanced to produce the highest quality cuts while maximizing consumable life. The torch is water-cooled and consumables are machined to exacting dimensions and checked with the latest computerized measuring systems. Five nozzle sizes (30, 50, 70, 100 and 150 amps) are available to produce excellent cut quality throughout the cutting range.

The degree of protection provided by the ProLine 2150 system is IP21S and as such is intended only for indoor use. It is not suitable for use in rain or snow.

The Proline 2150 system is tested in accordance with CISPR 11, EMC classification – Group 2 ISM (Class A).

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System Components

The ProLine 2150 consists of the following components:

Standard Components

- Power Supply
- Gas Console
- Remote High Frequency (RHF) Console
- RHF Console Control Cable
- Torch and Handle Assembly
- Torch Lead Set
- Torch Solenoid Valve Assembly
- Torch Solenoid Valve Control Cable
- Water and Power Leads
- Gas Hose Package
- Work Ground Lead
- System Manual
- Consumable Spare Parts Kit (see Section 6 for details)

Optional Components

- Remote On/Off Control Assembly
- Hydrogen Manifold Assembly

Power Supply Specifications

Stock Number:

208 VAC, 3Ø, 60Hz 150411
230/460 VAC, 3Ø, 60Hz 150412
380 VAC, 3Ø, 50/60Hz 150415
415 VAC, 3Ø, 50/60Hz 150414
575 VAC, 3Ø, 60Hz 150413

Input Current at Maximum Output:

208 VAC, 3Ø, 60Hz .....74 amps
230/460 VAC, 3Ø, 60Hz ..... 67/34 amps
380 VAC, 3Ø, 50/60Hz ..... 41 amps
415 VAC, 3Ø, 50/60Hz ..... 38 amps
575 VAC, 3Ø, 60Hz .....27 amps

Open Circuit Voltage ..... 300 VDC
Output Current (drooping characteristic).....8-150 amps
Maximum Output Voltage ..... ……170 VDC
Duty Cycle .....…….100% @ 25.5 kW
Maximum Ambient Temperature ..... 104° F (40° C

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Dimensions:
- Width ..... 30 in (762 mm)
- Height (including gas console) ..... 48 in (1219 mm)
- Depth ..... 43 in (1092 mm)

Weight (including gas console) ..... 700 lb (317 kg)

Torch Cooling System:
- Discharge pressure ..... 150 psi (10.2 bar)
- Flow rate .....1 gal/min (3.8 liters/min)
- Coolant fluid .....Propylene glycol/deionized water
- Coolant tank capacity ..... 3.2 gal (12 liters)

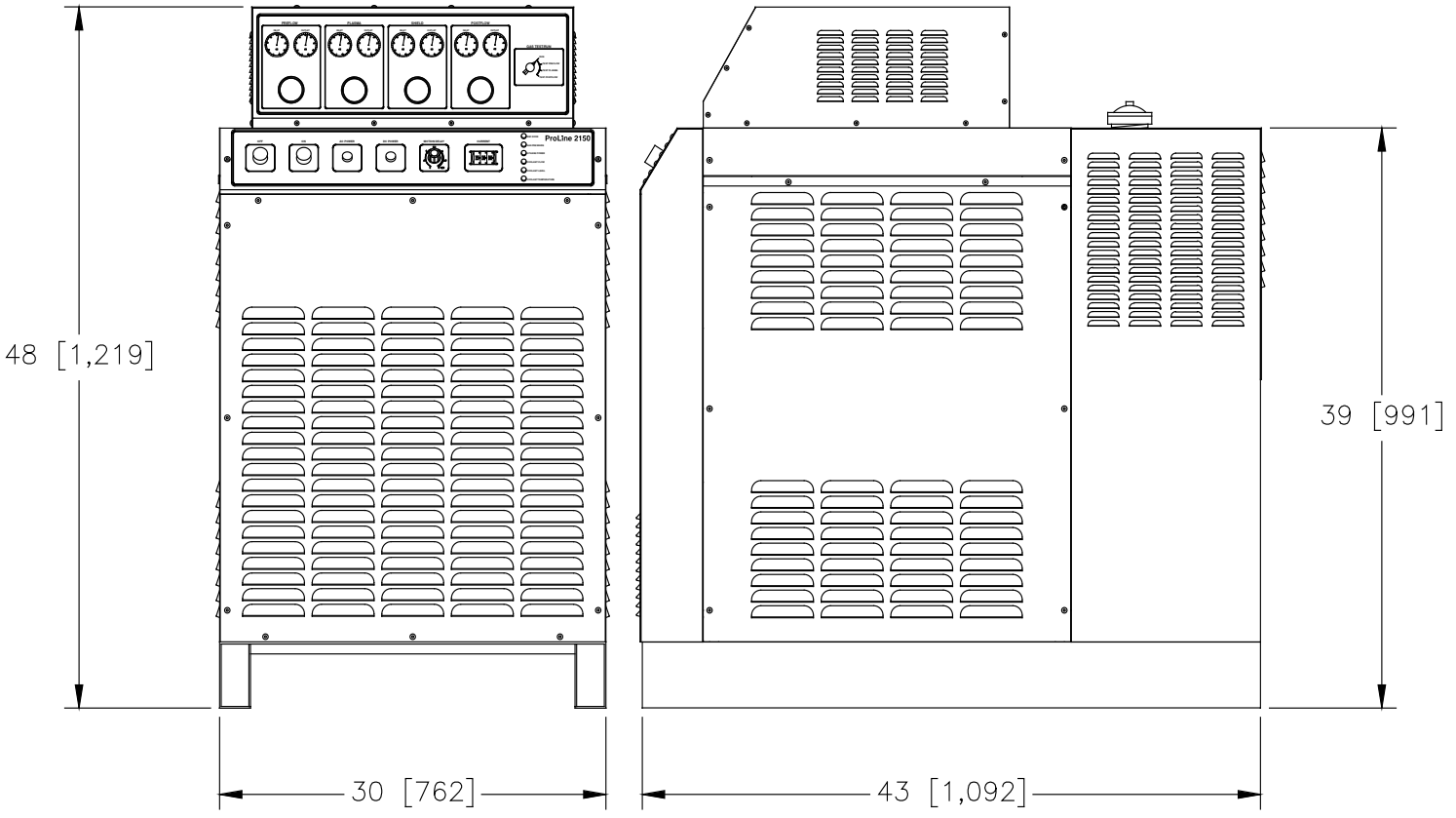

Figure 2-1 Power Supply Dimensions

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Gas Console Specifications

Stock Number (without Inova height control) 277080
Stock Number (with imperial Inova height control) 277085
Stock Number (with metric Inova height control) 277090
Height ..... 9 in (229 mm)
Width ..... 25 in (635 mm)
Depth ..... 23.8 in (605 mm)
Weight (with integrated Inova height control) ..... 75 lb (34 kg)
Weight (without integrated Inova height control) ..... 60 lb (27 kg)

Gas Supply Requirements

Plasma gas types:
- Mild Steel ..... Oxygen or Air
- Stainless Steel .....Air or H17 (optional)
- Aluminum .....Air

Shield gas types:
- Mild Steel ..... Oxygen or Air
- Stainless Steel ..... Air or Nitrogen
- Aluminum ..... Air or Nitrogen

Preflow gas type .....Air or Nitrogen

Plasma gas flow rate (maximum):
- Oxygen or Air ..... 30 scfh (850 liters/hour)
- H17 ..... 30 scfh (850 liters/hour)

Shield gas flow rate (maximum):
- Oxygen ..... 19 scfh (538 liters/hour)
- Air or Nitrogen ..... 87 scfh (2464 liters/hour)

Preflow gas flow rate (maximum) ..... 25 scfh (708 liters/hour)

Inlet gas pressures (rated / maximum)
- Oxygen ..... 120 psi (8.3 bar) / 150 psi (10.3 bar)
- Nitrogen .....120 psi (8.3 bar) / 150 psi (10.3 bar)
- Air .....120 psi (8.3 bar) / 150 psi (10.3 bar)
- H17 .....120 psi (8.3 bar) / 150 psi (10.3 bar)

Oxygen and nitrogen should be supplied with a purity of at least 99.5%. H17 should be supplied with a purity of at least 99.995%. **A potential fire hazard exists when cutting with oxygen. Flashback arrestors must be supplied to prevent a possible fire from propagating back to the gas supplies.** Ensure that oxygen lines remain free from contaminants such as oil and grease. The mixture of such contaminants with oxygen presents an additional fire hazard. Compressed air must be clean, dry, and oil-free and may be supplied from compressed cylinders or from an air compressor. Be aware that shop air systems are prone to oil and moisture contamination. If shop air is used, it must be cleaned to ISO 8573.1: Class 1.4.1. Specify dry air when using compressed cylinders. Breathing quality air contains moisture and must not be used. 1/4" (inside diameter) hoses are required for all inlet gas connections. Mating connectors are supplied with the unit. **Quick-connect fittings must not be used.**

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Remote High Frequency Console Specifications

Stock Number 205500
Height .....5.35 in (136 mm)
Width ..... 13.5 in (343 mm)
Depth ..... 10 in (25 mm)
Weight .....22 lb (10 kg)
Spark gap distance ..... .025 in (.635 mm)

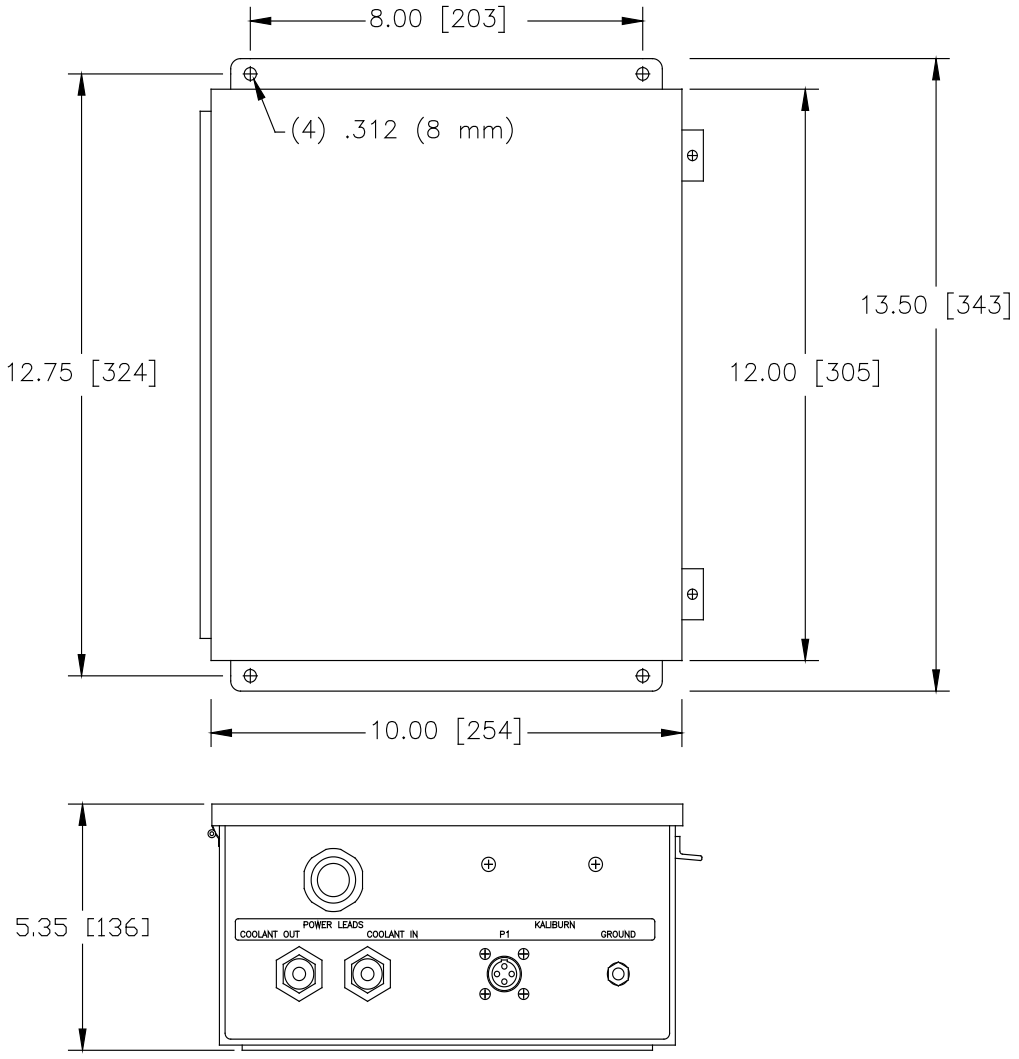

Figure 2-2 Remote High Frequency Console Mounting Dimensions

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Torch Specifications

Stock Number:

Torch Handle..... 820134
Torch Base 279050
Torch Head (Copper Electrode).....279150

Weight:

Valves, Handle, Base and Head..... 6.2 lb (2.8 kg)

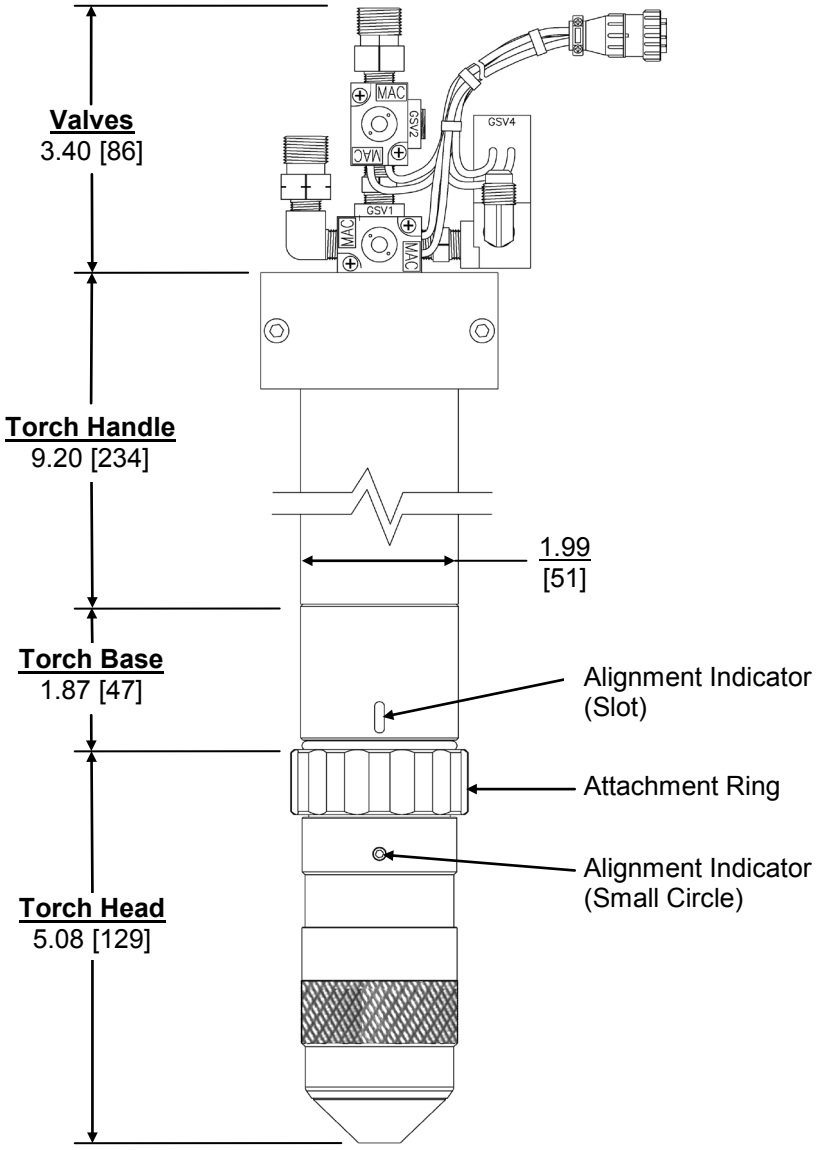

Figure 2-3 Torch Dimensions

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Remote On/Off Control Specifications (Optional)

Stock Number 277079
Height ..... 2.0 in (51 mm)
Width .....5.455 in (139 mm)
Depth .....4.4 in (112 mm)
Weight .....1.5 lb (.7 kg)

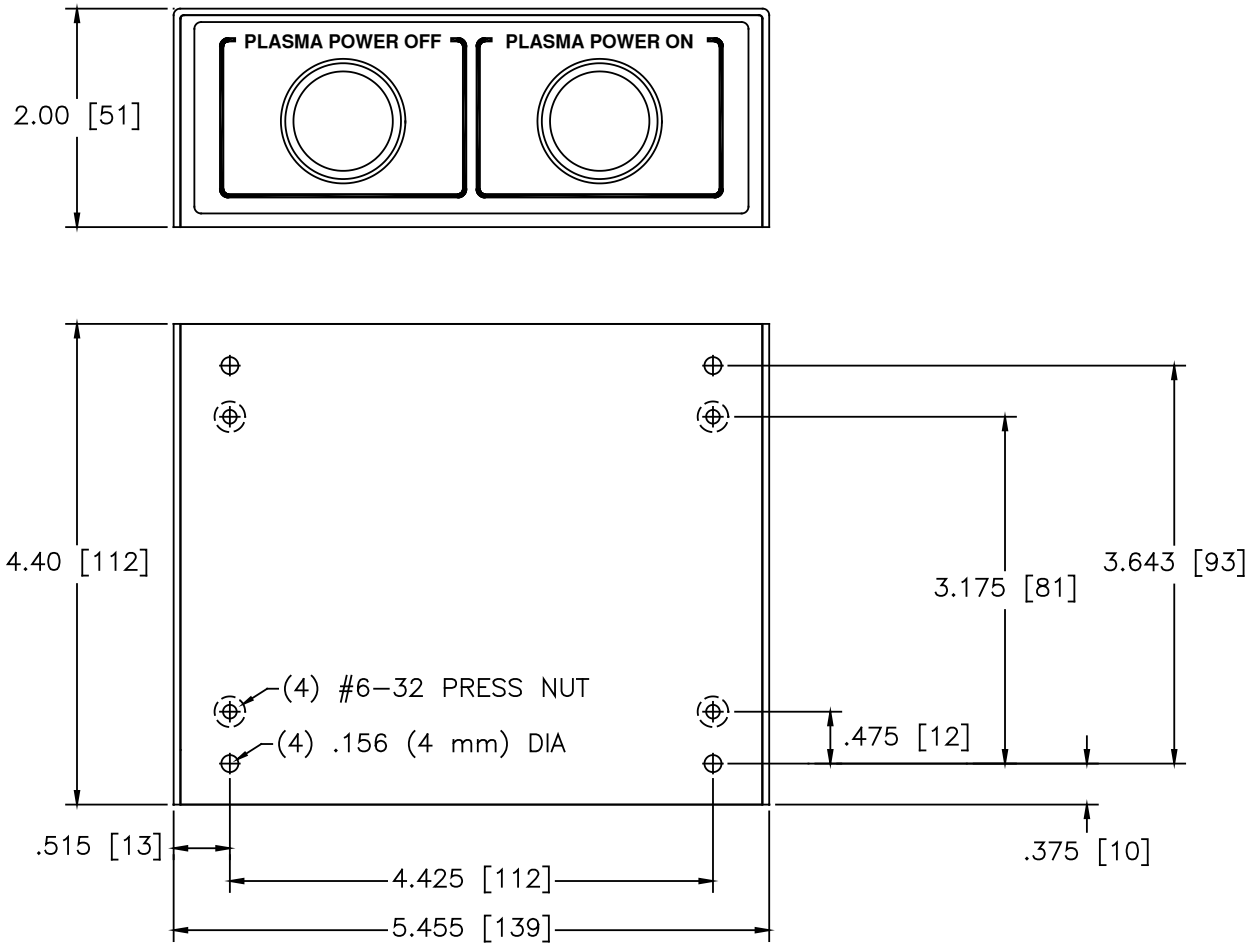

Figure 2-4 Remote On/Off Control Dimensions (Optional)

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Hydrogen Manifold Specifications (Optional)

Stock Number 150098
Height ..... 6.15 in (156 mm)
Width .....7.11 (181 mm)
Depth .....6.25 in (159 mm)
Weight .....6.0 lb (2.7 kg)

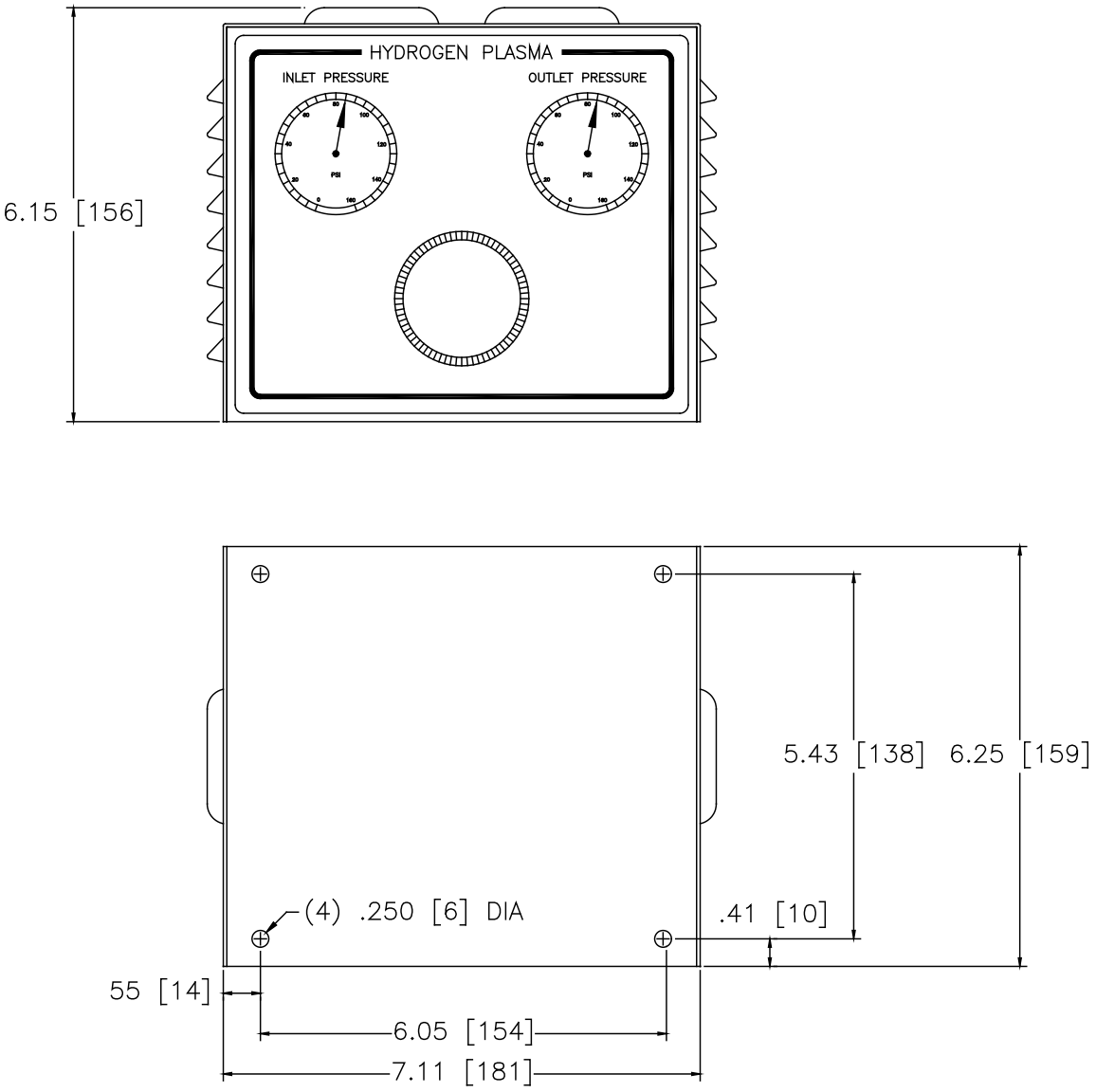

Figure 2-5 Hydrogen Manifold Dimensions (Optional)

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Airborne Noise Emissions

The ProLine 2150 system generates high noise levels while cutting. Depending on the size of the cutting area, distance from the cutting torch, and arc current cutting level, acceptable noise levels may be exceeded. Proper ear protection should be used as defined by local or national codes. The following chart gives the noise levels generated by the ProLine 2150 when operating at 150 amps, 130 arc volts. The measurements were made with a sound level meter.

Distance From Torch	A-Weighted Sound Pressure Level	C-Weighted Sound Pressure Level
1 meter horizontal / 1.6 meters above the workpiece	97 dB	94 dB

The maximum noise level is 121 dB at a distance of 3 inches (76.2 mm) from the torch while cutting at 150 amps, 130 arc volts.

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Section 3 Installation

Initial Inspection

All systems undergo full testing before being shipped from KALIBURN. In the unlikely event that one of your components is defective or missing, please contact KALIBURN so a replacement item can be sent to you. Also, KALIBURN has taken special care in packaging your ProLine 2150 system. If your system was damaged during shipment, you will have to file a claim with the shipping company. Next, it will be necessary to contact KALIBURN so replacement parts can be ordered. If you need additional assistance, please contact KALIBURN.

System Interconnection

The ProLine 2150 system interconnection diagram, Figure 3-1, will assist you in identifying cables and hoses upon receipt of your system. Electrical cables are marked with the appropriate plug number or letter and can be identified on the diagram. The Inova arc voltage control is also shown to assist in its hookup.

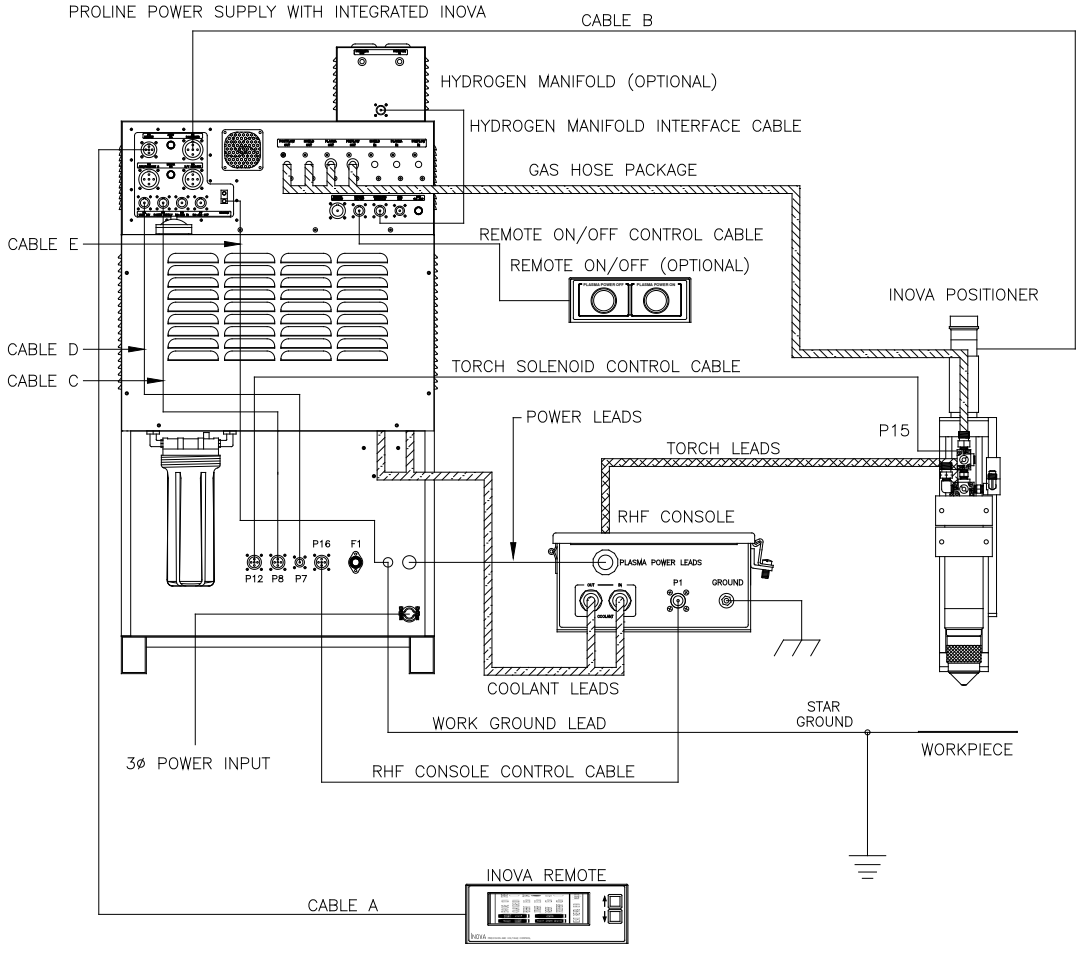

Figure 3-1 System Interconnection Diagram

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Power Supply Installation

The ProLine power supply should be lifted by a forklift or pallet jack. In order to prevent damaging the power supply, the forks should be of adequate length to protrude on the far side of the power supply. The proper location of the power supply will provide dependable service and reduce periodic maintenance time. Choose a location that will provide unrestricted air movement into and out of the power supply. Maintain **at least 24 inches** of space on **all** sides of the unit. The location should subject the power supply to the least amount of dust, dirt, moisture, and corrosive vapors. The surface on which the power supply is located should have a grade of no greater than 10º to eliminate the risk of toppling over. The power supply must be cleaned as often as necessary to prevent the accumulation of metallic dust inside the unit. See Figure 2-1 for power supply dimensions.

Remote High Frequency Console Installation

The Remote High Frequency (RHF) Console should be mounted in a convenient location that is away from other electronic control devices. The high voltage, high frequency signal generated inside the unit can interfere with the operation of certain control systems. The RHF console is usually mounted on the gantry of the cutting machine or on the cutting table. See Figure 2-2 for RHF console mounting dimensions.

Torch Installation

The ProLine 2150 torch must be installed on the positioner of an arc voltage control capable of maintaining the cutting arc voltage within 1 arc volt. The arc voltage must be adjustable in 1 arc volt increments. The positioner must be rigid to ensure cut quality and a torch collision sensor is highly recommended. See Figure 2-3 for torch mounting dimensions.

Primary Power Connection

**** Before connecting primary power, check the data plate to verify the voltage required by the ProLine power supply ****

A primary disconnect switch, switching all ungrounded supply conductors, should be provided for each ProLine power supply. The disconnect switch should be located as close as possible to the power supply so it can be turned off quickly in case of an emergency. **The disconnect switch should be equipped with time delay fuses only**. The magnetic inrush current of the power supply will cause fast acting fuses to blow. The disconnect switch should be sized according to local and national codes. The rating must meet or exceed the continuous rating of the fuses used. See the following chart for recommended fuse sizes:

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3 Phase Input Voltage (VAC)	Input Current at Maximum Output (amps)	Recommended Time-Delay Fuse Size (amps)
208V 60Hz	74	100
230V 60Hz	67	90
380V 50/60Hz	41	60
415V 50/60Hz	38	50
460V 60Hz	34	50
575V 60Hz	27	40

Use a Type SO power cable to connect the primary power to the ProLine power supply. The power cable should have a 600 volt minimum rating and should be sized according to local and national codes. Route the power cable through the lower strain relief on the rear of the power supply and connect it to the input terminal block TB5 as shown in Figure 3-2. TB5 is located on the base of the power supply behind the left side cover. **Be sure to connect the primary ground cable to the ground stud on the input terminal block**.

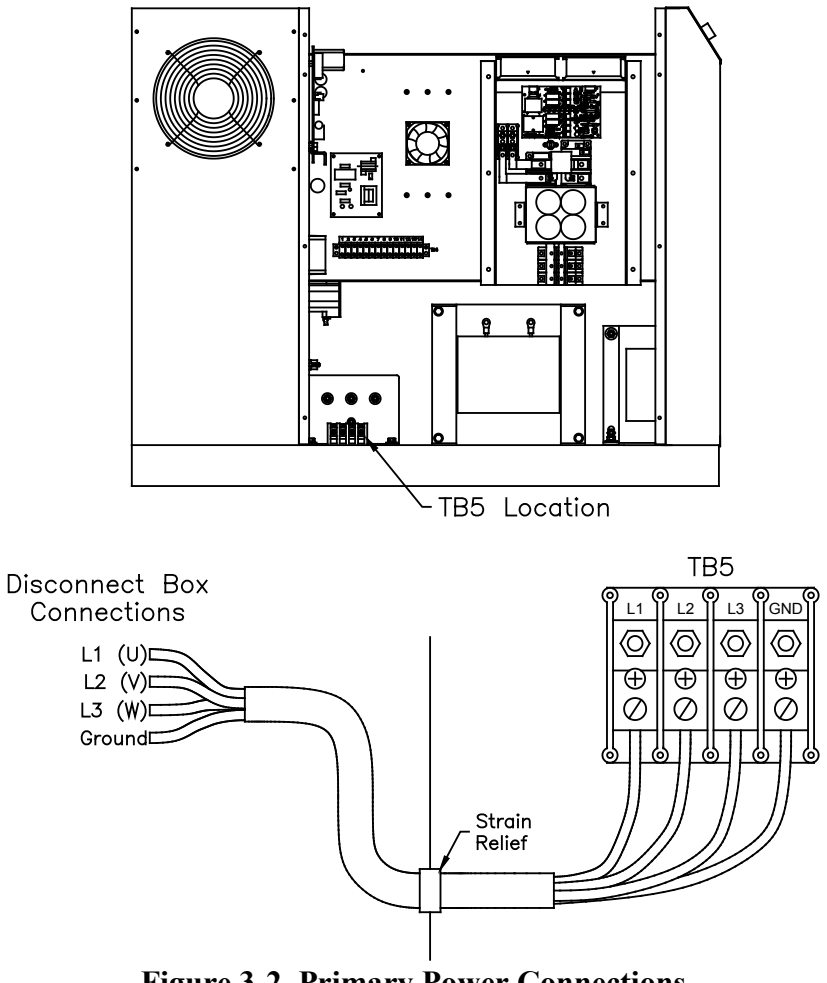

Figure 3-2 Primary Power Connections

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Power Supply Output Connections

Perform the following steps to connect the output of the power supply to the RHF console and the work table. See Figure 3-3 for additional information.

Power Supply Electrode Lead (1)

1. Route one end of the #1/0AWG Power Supply Electrode Lead through the upper strain relief on the rear of the power supply and connect it to the Electrode terminal.
2. Route the other end of the Power Supply Electrode Lead through the strain relief on the RHF console and connect it to the cathode manifold.

Power Supply Nozzle Lead (2)

1. Route one end of the #10AWG Power Supply Nozzle Lead through the upper strain relief on the rear of the power supply and connect it to the Nozzle terminal.
2. Route the other end of the Power Supply Nozzle Lead through the strain relief on the RHF console and connect it to the Pilot terminal on the RHF console printed circuit board.

Power Supply CTP Sensor Lead (3)

1. Route the end of the #14AWG Power Supply CTP Sensor Lead with the ring terminal through the middle strain relief on the rear of the power supply and connect it to the CTP terminal.
2. Route the end of the Power Supply CTP Sensor Lead with the fast-on terminal through the strain relief on the RHF console and connect it to the CTP sensor lead filter assembly.

RHF Console Control Cable (4)

1. Connect the RHF Console Control Cable plug labeled P16 to the connector labeled P16 on the rear of the power supply.
2. Connect the RHF Console Control Cable plug labeled P1 to the connector labeled P1 on the RHF console.

Power Supply Coolant Supply Hose (5)

1. Connect one end of the Power Supply Coolant Supply Hose to the coolant supply fitting on the rear of the power supply. Note that the coolant supply fitting has right hand threads.
2. Connect the other end of the Power Supply Coolant Supply Hose to the coolant in fitting on the RHF console. Note that the coolant in fitting has right hand threads.

Power Supply Coolant Return Hose (6)

1. Connect one end of the Power Supply Coolant Return Hose to the coolant return fitting on the rear of the power supply. Note that the coolant return fitting has left hand threads.
2. Connect the other end of the Power Supply Coolant Return Hose to the coolant out fitting on the RHF console. Note that the coolant out fitting has left hand threads.

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Work Ground Lead (7)

1. Route one end of the #1/0AWG Work Ground Lead through the middle strain relief on the rear of the power supply and connect it to the Work terminal.
2. Connect the other end of the Work Ground Lead to the star ground point on the cutting table. The star ground point is generally referred to as the common ground point on the cutting table where all subsystems of the machine are grounded. This point is then connected to a driven earth ground rod that should be as close as possible to the star ground. The ground rod should have no other wires connected to it. The ground rod should be at least 3/4 inches in diameter and should be driven into the earth's permanent moisture layer. The length of the ground rod varies from installation to installation and should be installed according to local and national codes. Refer to the National Electrical Code, Article 250, Section H, Ground Electrode System for additional information.

RHF Console Ground Connection (8)

Perform the following steps to connect the chassis of the RHF Console to the cutting table. See Figure 3-3 for additional information.

1. Connect one end of the RHF Console Ground Lead to the ground stud on the RHF console.
2. Connect the other end of the RHF Console Ground Lead to chassis ground on the cutting table. Make sure that good metal-to-metal contact is made.

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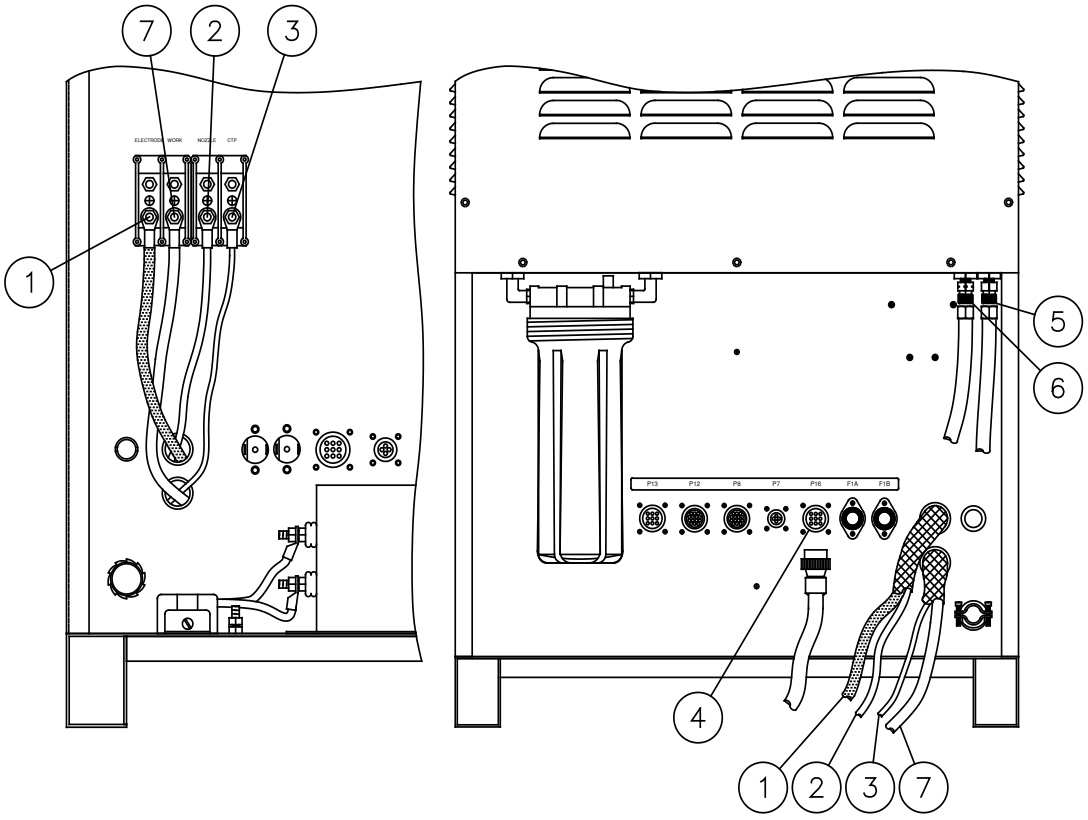

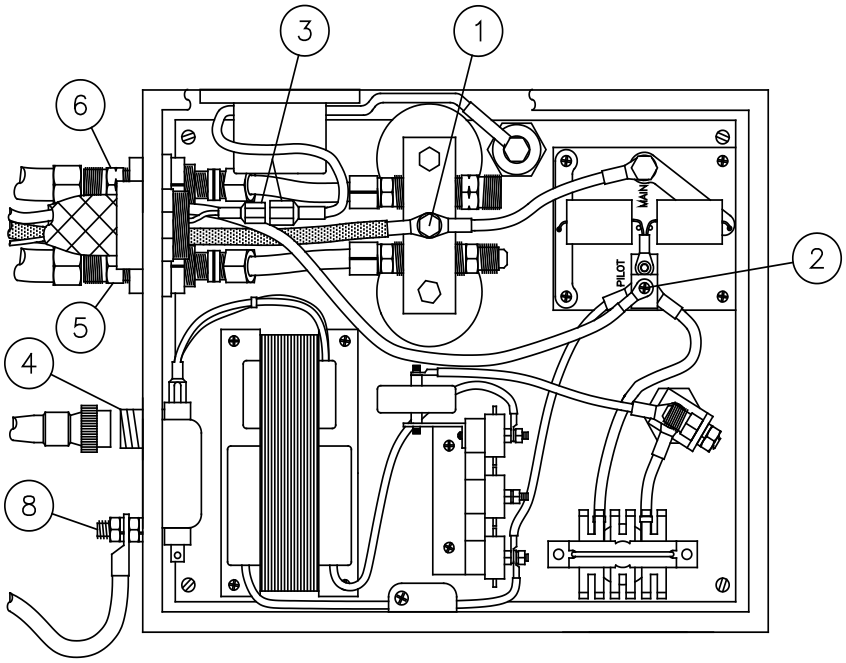

Figure 3-3 Power Supply Output Connections

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Torch Leads to RHF Console Connections

Perform the following steps to connect the torch leads to the RHF console. See Figure 3-4 for additional information.

Note: When making hose connections, only tighten the brass fittings enough to make water or gas seals. The fittings are subject to damage if over tightened.

Braided Shield (9)

- Remove the threaded ring from the brass shield connector on the end of the braided shield. Route the torch leads through the opening in the RHF console and push the shield connector through the hole until it is seated against the side of the console.
- Slide the threaded ring over the torch leads, thread it onto the brass shield connector, and **tighten firmly**. The shield connector should ground the braided shield to the case of the RHF console in order to help reduce high frequency noise emission. Using an ohmmeter, measure for zero ohms between the braided shield and the ground stud located on the outside of the RHF console.

Torch Electrode/Coolant Supply Lead (10)

- Connect the Torch Electrode/Coolant Supply Lead to the brass cathode manifold. Note that the Torch Electrode/Coolant Supply Lead has right hand threads.

Torch Coolant Return Lead (11)

- Connect the Torch Coolant Return Lead to the brass cathode manifold. Note that the Torch Coolant Return Lead has left hand threads.

Torch Nozzle Lead (12)

- Connect Torch Nozzle Lead to the angled bracket on the red standoff. Note that the Torch Nozzle Lead has right hand threads.

Torch CTP Sensor Lead (13)

- Connect the #18AWG Torch CTP Sensor Lead to the red standoff as shown.

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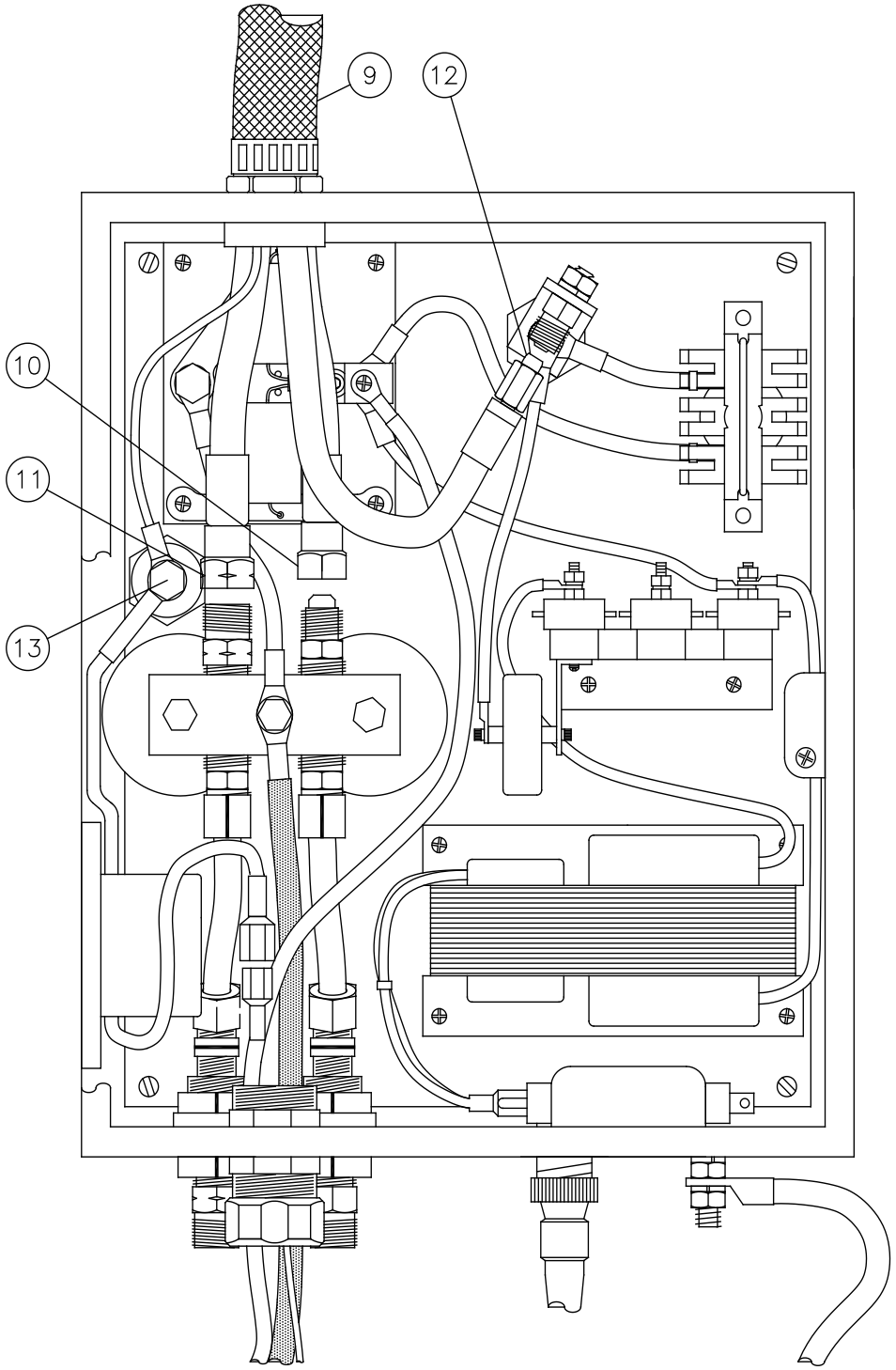

Figure 3-4 Torch Leads to RHF Console Connections

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Torch Connections

Perform the following steps to connect the torch leads and gas hoses to the torch base and torch solenoid assembly. See Figure 3-5 for additional information.

Note: When making hose connections, only tighten the brass fittings enough to make water or gas seals. The fittings are subject to damage if over tightened. Also, use two wrenches when tightening the torch fittings to avoid damaging the torch

Gas Hose Package/Torch Solenoid Control Cable Installation

- Route the Plasma, Shield, Preflow, and Postflow Gas Hoses and the Torch Solenoid Control Cable from the power supply to the torch station. Note that the Shield Gas Hose extends down inside the torch handle, so it should be routed accordingly. Also, plug P12 on the Torch Solenoid Control Cable attaches at the power supply and P15 attaches to the torch solenoid assembly.

Torch Handle Installation

- Route the torch leads through the torch handle. Note that the threaded end of the torch handle mates with the torch base.
- Route the Shield Gas Hose through the torch handle.
- Route the 15" Torch Plasma Gas Hose through the torch handle. Note that the larger fitting on the Torch Plasma Gas Hose mates with the torch base.

Torch Electrode/Coolant Supply Lead (10)

- Connect the Torch Electrode/Coolant Supply Lead to the torch as shown.

Torch Coolant Return Lead (11)

- Connect the Torch Coolant Return Lead to the torch base as shown. Note that the Torch Coolant Return Lead fitting has left hand threads.

Torch Nozzle Lead (12)

- Connect the Torch Nozzle Lead to the torch base as shown.

Torch CTP Sensor Lead (13)

- Connect the Torch CTP Sensor Lead to the torch base as shown.

Shield Gas Hose (14)

- Connect the Shield Gas Hose to the torch base as shown.

Torch Plasma Gas Hose (15)

- Connect the Torch Plasma Gas Hose to the torch base as shown.

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Torch to Torch Handle Installation

- Thread the torch handle onto the torch base.
- Tighten the base to the handle using a pin style adjustable spanner wrench (fits 2" diameter with ¼" diameter pin).
- Attach the solenoid valve assembly to the torch handle. The top of the aluminum solenoid bracket should be flush with the top of the torch handle.
- Mount the torch handle/base/valves to the positioner. Note the alignment indicators on the torch base (slot) and torch head (small circle). These aid in aligning the quick-disconnect torch base and head and should be oriented so they are clearly visible when the operator is changing heads.

Torch Plasma Gas Hose (16)

- Connect the Torch Plasma Gas Hose to the solenoid outlet port as shown.

Preflow Gas Hose (17)

- Connect the Preflow Gas Hose to the solenoid preflow inlet port as shown. Note that the Preflow Gas Hose fitting has a left hand thread.

Plasma Gas Hose (18)

- Connect the Plasma Gas Hose to the solenoid plasma inlet port as shown.

Postflow Gas Hose (19)

- Connect the Postflow Gas Hose to the solenoid postflow inlet port as shown.

Torch Solenoid Control Cable (20)

- Connect the Torch Solenoid Control Cable plug marked P15 to the torch solenoid assembly as shown. Connect the Torch Solenoid Control Cable plug labeled P12 to the connector labeled P12 on the rear of the power supply.

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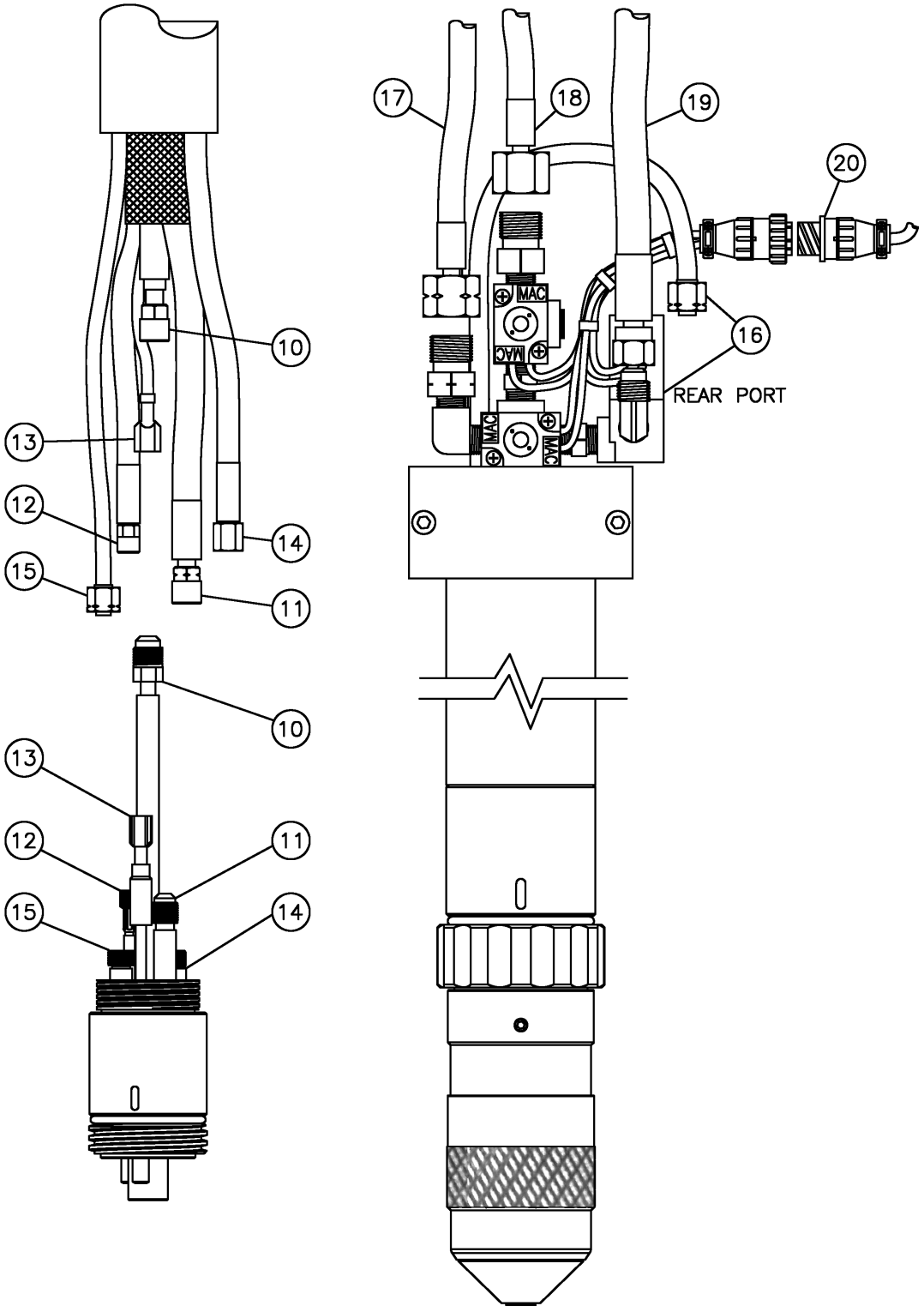

Figure 3-5 Torch Connections

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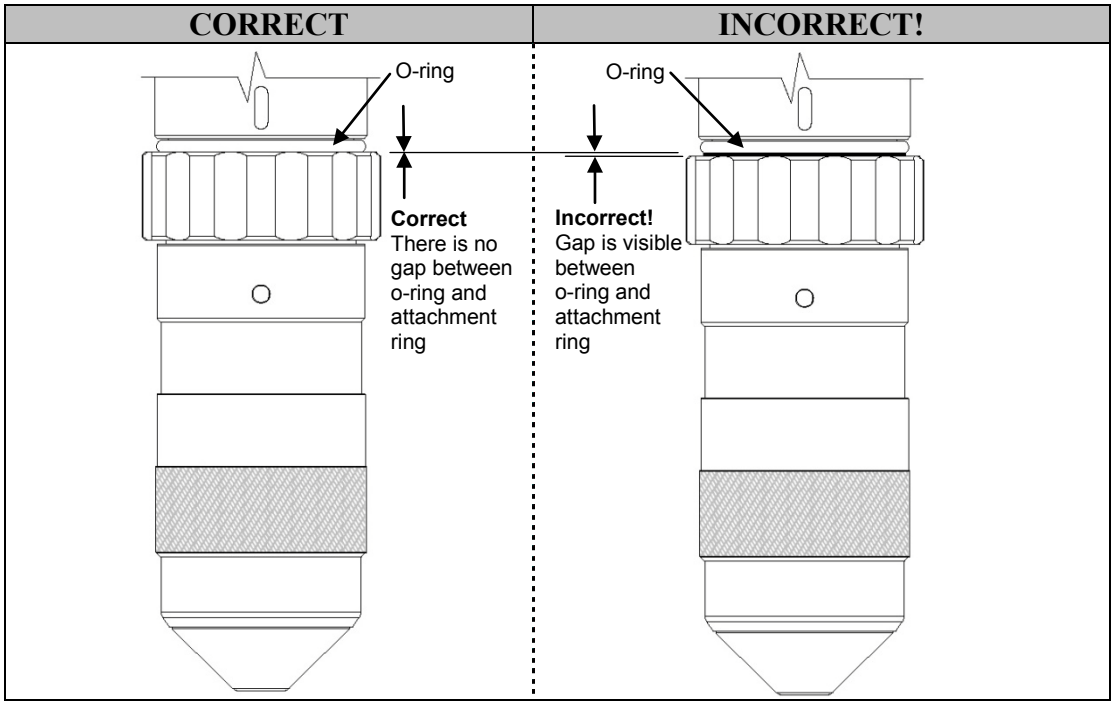
Torch Head Connection

Perform the following steps to connect the torch head to the torch base.

1. Each time the torch head is connected to the torch base, use a cotton swab to apply a small amount of o-ring lubricant on each of the seven o-rings on the top of the torch head. **Reminder: do not use an excessive amount of o-ring lubricant.**
2. Align the indicator on the torch head (small circle) with the one on the torch base (slot).
3. Apply enough upward force to engage the threads while tightening the attachment ring. Turn the attachment ring to the LEFT to tighten.
4. Keep tightening the attachment ring until it stops. As shown below, the attachment ring will NOT cover the o-ring. This is only a visual indicator; no seal is created. However, there should be no gap between the attachment ring and the o-ring.

   During the tightening process (after the initial install) a small amount of coolant will collect in the torch head. It is normal for this coolant to discharge between the o-ring on the torch base and the attachment ring while the system is being pressurized. If coolant continues to discharge after the system is pressurized, turn off the plasma power supply, remove the torch head and inspect the o-rings for damage.



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Gas Console Input Connections

Perform the following steps to connect the gas supply lines to the automatic gas console. See Section 2 for gas supply requirements. Mating hose barbs and connectors are supplied with the system and are sized for 1/4 inch inside diameter hose. **Do not change the inlet gas supply fittings to quick-connect fittings. Using quick-connect fittings to connect and disconnect pressurized hoses may cause damage to the system.**

Note: When making hose connections, only tighten the brass fittings enough to make gas seals. The fittings are subject to damage if over tightened.

Preflow Inlet (21)

- Connect the proper preflow gas to the Preflow In port. See the cutting charts in Section 4 for gas types.

Plasma Inlet (22)

- Connect the proper plasma gas to the Plasma In port. See the cutting charts in Section 4 for gas types.

Shield Inlet (23)

- Connect the proper shield gas to the Shield In port. See the cutting charts in Section 4 for gas types.

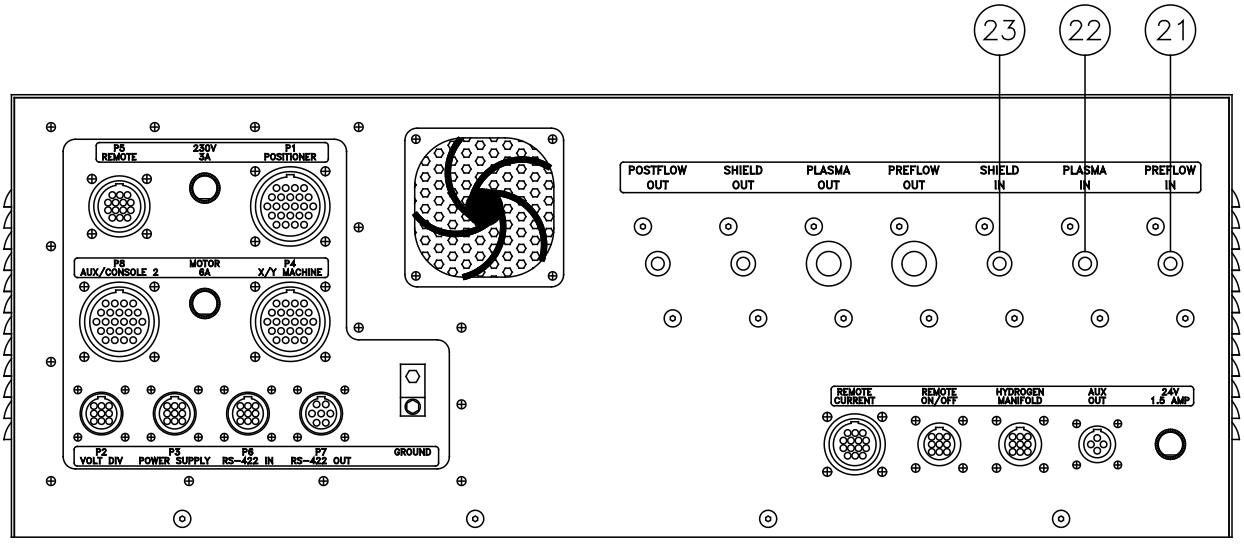

Figure 3-6 Gas Console Input Connections

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Gas Console Output Connections

Perform the following steps to connect the automatic gas console outputs to the torch gas hoses.

Note: When making hose connections, only tighten the brass fittings enough to make gas seals. The fittings are subject to damage if over tightened.

Preflow Outlet (24)

- Connect the preflow hose to the Preflow Out port as shown. Note that the Preflow Out port has left hand threads.

Plasma Outlet (25)

- Connect the plasma hose to the Plasma Out port as shown. Note that the Plasma Out port has right hand threads.

Shield Outlet (26)

- Connect the shield hose to the Shield Out port as shown. Note that the Shield Out port has right hand threads.

Postflow Outlet (27)

- Connect the postflow hose to the Postflow Out port as shown. Note that the Postflow Out port has right hand threads.

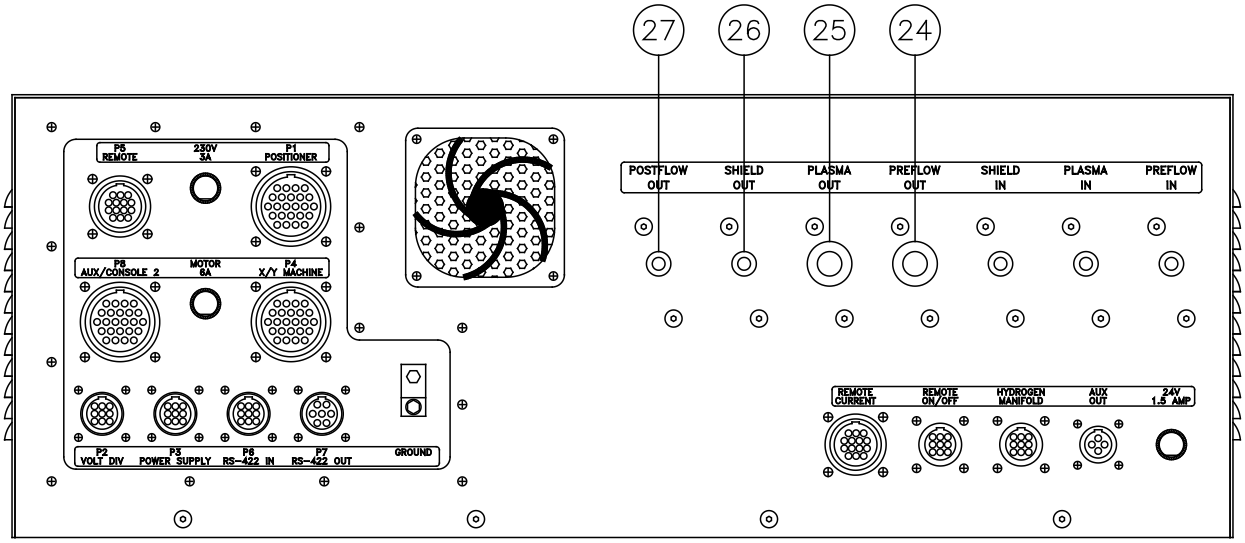

Figure 3-7 Gas Console Output Connections

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CNC Machine Interface Connections

Perform the following steps to properly interface the ProLine 2150 system with a CNC cutting machine. See the system schematic for additional information.

Plasma Start Signal

- The ProLine 2150 requires a contact closure between P8 pins 3 and 4 to commence the cutting sequence. The cutting sequence is terminated when the contacts are opened. The contacts should be rated for 12VDC - 10mA. If the ProLine 2150 is ordered with the integrated Inova system, see below for interface information.

Arc Hold / IHS Complete Signal

- The ProLine 2150 requires a contact closure between P8 pins 10 and 11 to inhibit arc starting even though a plasma start signal has been applied to the unit. When the arc hold / IHS complete contacts are opened, the cutting arc is initiated. This feature is used to decrease cycle time by allowing pre-cut gas and contact sequencing to occur simultaneously with initial torch height positioning. The contacts should be rated for 12VDC - 10mA. If the ProLine 2150 is ordered with the integrated Inova system, see below for interface information.

Motion Output Signal

- The ProLine 2150 provides a maintained contact closure output between P8 pins 12 and 14 as long as a cutting arc is maintained between the torch and the workpiece. The motion contacts are rated for .6A - 125VAC / .6A - 110VDC / 2A - 30VDC. If the ProLine 2150 is ordered with the integrated Inova system, see below for interface information.

Inova Connections (optional)

- When the ProLine 2150 is ordered with the integrated Inova torch height control system, connect the Inova C cable between P8 on the rear of the power supply and P3 on the Inova control panel. The C cable is used to interface the plasma start, plasma hold, and machine motion signals between the Inova and the ProLine 2150. Next, connect the Inova D cable between P7 on the rear of the power supply and P2 on the Inova control panel. The Inova D cable is used to interface the cutting arc voltage and plate sensing circuit between the Inova and the ProLine 2150. Next, connect the Inova E cable between the Work terminal on the ProLine power supply and the Ground lug on the Inova control panel. Note that the E cable is not a safety ground. It is part of the voltage feedback circuit used for arc voltage control. See the Inova manual for details on x/y machine, operator's remote, and positioner interface.

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Torch Coolant Requirements

Note: Refer to the supplier's most current Material Safety Data Sheet for information regarding safety, handling, and storage of torch coolant.

The ProLine 2150 system is shipped without torch coolant in the reservoir. **Coolant must be added before applying power to the system.** Only use Kaliburn approved torch coolant solution for optimal system performance as commercially available antifreeze contains corrosion inhibitors that will damage the cooling system. The standard coolant solution consists of 25% industrial grade propylene glycol and provides freezing protection down to -13º C (9º F). The standard solution can be ordered in one-gallon containers, PN 500695. For operating temperatures below -13º C, a 50% solution of industrial grade propylene glycol can be ordered in one-gallon containers, PN 500895, providing protection down to -36º C (-33º F).

Failure to use the proper propylene glycol solution may result in cooling system and/or torch damage.

The torch coolant should be flushed out of the ProLine system every six months and replaced with new coolant. The water filter/deionization cartridge should also be changed at the same time. See Section 5 for details.

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Initial Filling of the Torch Coolant Reservoir

Note: Never turn on the power supply before filling the torch coolant reservoir with the proper coolant solution.

When handling coolant, it is recommended that you wear nitrile gloves and safety glasses.

1. Remove the coolant reservoir cap and fill the reservoir with 2 gallons of coolant solution.
2. Apply main power to the ProLine unit.
3. Depress and hold the green ON button on the ProLine control panel.
4. The coolant pump will begin pumping coolant fluid through the system. The Coolant Flow LED will remain out until the coolant has filled the entire system and begins flowing back into the tank. The coolant pump will turn off if the coolant level drops below the minimum level inside the reservoir. If this happens, add more coolant solution to the reservoir and return to Step 3.
5. When the Coolant Flow LED illuminates, release the green ON switch. The ProLine system should remain energized and continue pumping coolant through the system.
6. Locate the small red push-button on top of the coolant filter/deionization cartridge. Depress and hold the button until no air is seen inside the clear filter housing.
7. Fill the reservoir with coolant solution until the coolant gauge indicates full. Coolant should be added to the system any time the level drops below half full.
8. Check for coolant leaks at all hose connections inside the power supply, RHF console, and at the torch.

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Optional Remote On/Off Control Installation

Install the remote on/off control on the operator's control station. The control has four mounting holes and four #6-32 press nuts on the bottom for installation. See Figure 2-4 for mounting dimensions. After the control has been mounted, connect the Remote On/Off Control Cable between the plug on the rear of the remote on/off control and the plug labeled Remote On/Off on the rear of the ProLine 2150 gas console. Note that the cable has a key installed on the end that plugs into the gas console.

Optional Hydrogen Manifold Installation

The hydrogen manifold is designed to be installed on the top of the gas console using the two left rear mounting holes of the gas console cover (as viewed from the front of the power supply). Simply remove the cover of the hydrogen manifold, remove the two left rear gas console cover screws, then reinstall the cover screws after inserting them through the holes in the bottom of the hydrogen manifold. After the manifold has been mounted, replace the hydrogen manifold cover and connect the Hydrogen Manifold Interface Cable between the plug on the rear of the hydrogen manifold and the plug labeled Hydrogen Manifold on the rear of the ProLine 2150 gas console. Note that the cable has a key installed on the end that plugs into the gas console.

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Section 4 Operation

Power Supply Front Panel Controls

All of the ProLine controls and status indicator lights are located on the front panel of the system. This section describes the function of each control and indicator.

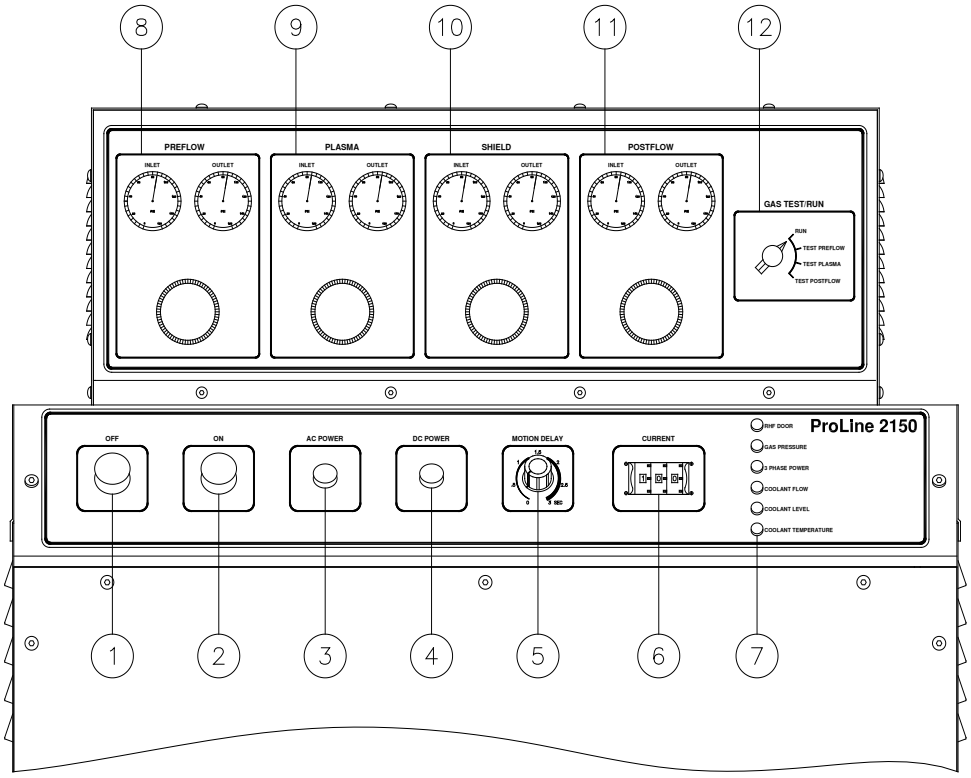

Figure 4-1 Front Panel Controls

Power Off Button (1)

Deenergizes the ProLine system and turns off the cooling fans and coolant pump.

Power On Button/Indicator (2)

Energizes the ProLine system and turns on the cooling fans and coolant pump. Illuminates to show that the system is energized.

AC Power Indicator (3)

Illuminates when 3 phase power is applied to the ProLine system.

DC Power Indicator (4)

Illuminates when then main contactor has been energized and D.C. current is flowing through the torch.

Motion Delay Potentiometer (5)

Used to delay the x/y machine motion when piercing thicker materials. The delay can be adjusted from 0 to 3 seconds.

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Current Thumbwheel (6)
Used to set the output current of the ProLine 2150. The output current can be set to 10, 30, 50, 70, 100, and 150 amps.

Status Indicators (7)

- **RHF Door Indicator**
  Illuminates when the RHF console door is closed securely. Remains extinguished when the RHF console door is open.
- **Gas Console Indicator**
  Illuminates when the automatic gas console is operational. Remains extinguished when there is a problem with the gas system. Check the message screen on the automatic gas console for errors.
- **3 Phase Power Indicator**
  Illuminates when 3 phase power is satisfactory. Remains extinguished when there is a problem with main 3 phase power to the system.
- **Coolant Flow Indicator**
  Illuminates when the coolant flow through the system is satisfactory. Remains extinguished when the coolant flow through the system is restricted.
- **Coolant Level Indicator**
  Illuminates when the coolant level inside the reservoir is satisfactory. Remains extinguished when coolant must be added to the system.
- **Coolant Temperature Indicator**
  Illuminates when the torch coolant temperature is satisfactory. Remains extinguished when the coolant temperature is too hot. If the torch coolant indicator goes out, leave the unit energized until it illuminates.

Preflow Gas Control (8)
Displays the preflow gas inlet and outlet pressures and provides a preflow gas outlet pressure regulator.

Plasma Gas Control (9)
Displays the plasma gas inlet and outlet pressures and provides a plasma gas outlet pressure regulator.

Shield Gas Control (10)
Displays the shield gas inlet and outlet pressures and provides a shield gas outlet pressure regulator.

Postflow Gas Control (11)
Displays the postflow gas inlet and outlet pressures and provides a postflow gas outlet pressure regulator.

Gas Test/Run Switch (12)
In the test modes, the selected gas solenoids are energized so the gas pressures can be properly adjusted prior to cutting. Test mode also allows the operator to manually purge the gas lines as required, i.e. after switching to a different type of gas. In the Run mode, all gas solenoids are controlled by the microprocessor board.

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Optional Hydrogen Manifold Controls

The hydrogen manifold can be used when cutting stainless steel at least 3/16" (4.75 mm) thick and a smooth, shiny cut surface finish is desired. When using the manifold, H17 (17.5% hydrogen / 32.5% argon / 50% nitrogen) must be connected to the Hydrogen In port and the Plasma Out hose must be connected to the Hydrogen Out port. **H17 must not be routed through the ProLine 2150 gas console.**

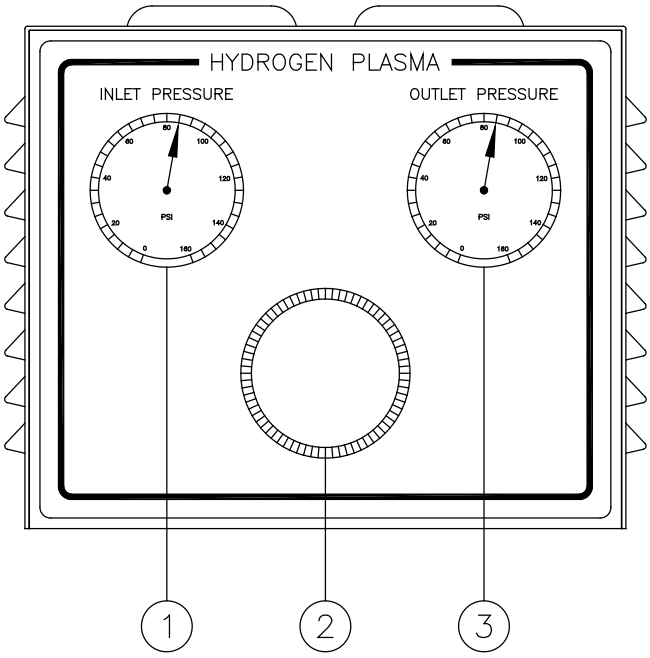

Figure 4-2 Hydrogen Manifold Controls (Optional)

Inlet Pressure Gauge (1)
Displays the H17 incoming supply pressure.

Outlet Pressure Regulator (2)
Adjusts the H17 outlet pressure.

Outlet Pressure Gauge (3)
Displays the H17 outlet pressure.

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Setting up a Cut

Note: When installing the torch parts, do not use an excessive amount of o-ring lubricant. Also, ensure that the lubricant is placed only on the o-rings. Excess lubricant can interfere with gas flow, cause starting problems, and shorten consumable life.

1. Turn off the primary power to the unit.
2. Using the cutting charts found in the rear of this section, determine the proper torch parts and cutting conditions for the material being cut.
3. For a copper electrode, apply a small amount of o-ring lubricant to the two o-rings on the electrode. Then, use the tool (P/N 277087) to tighten the electrode into the torch head.
4. Apply a small amount of o-ring lubricant to the two o-rings on the swirl ring and insert the swirl ring into the nozzle.
5. Apply a small amount of o-ring lubricant to the two o-rings on the nozzle and push the swirl ring/nozzle assembly into the torch head until it is seated properly.
6. Inspect the threads on the torch base/head, copper inner retaining cap, and brass outer cap and clean as necessary.
7. Install a small amount of o-ring lubricant to the three o-rings on the torch head.
8. Install the inner retaining cap onto the torch head. Tighten the cap firmly but do not over tighten.
9. Apply a small amount of o-ring lubricant to the shield cap o-ring and install the shield cap into the brass outer cap. ***Note: Make sure the shield cap o-ring is seated properly inside the outer cap.***
10. Install the outer cap onto the torch head and tighten firmly. Do not over tighten.
11. Apply a small amount of o-ring lubricant on each of the seven o-rings on the top of the torch head.
12. Align the indicator on the torch head (small circle) with the one on the torch base (slot).
13. Apply enough upward force to engage the threads while tightening the attachment ring. Turn the attachment ring to the LEFT to tighten.
14. Connect the correct preflow, plasma, and shield gas types to the gas inlet ports on the rear of the gas console. ***When using H17 as the plasma gas, connect the H17 gas supply to the Hydrogen In port on the H17 manifold and move the Plasma Out hose from the ProLine 2150 gas console to the Hydrogen Out port on the H17 manifold. Do not route H17 through the ProLine 2150 gas console. Note: Always turn the system off prior to changing gases.***
15. Depress and hold the Power On button until the Coolant Flow status LED illuminates. If the Coolant Flow LED fails to illuminate after 10 seconds, see the maintenance section for possible causes and solutions.

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16. Set the Gas Test/Run switch to the Test Preflow position. Adjust both the preflow and shield outlet pressures to their correct values as indicated in the cutting chart. Note that final shield outlet pressure adjustment will be performed in the next step.
17. Set the Gas Test/Run switch to the Test Plasma position. Adjust both the plasma and shield outlet pressures to their correct values as indicated in the cutting chart.
18. Set the Gas Test/Run switch to the Test Postflow position and adjust the postflow outlet pressure to the correct value as indicated in the cutting chart.
19. Return the Gas Test/Run switch to the Run position.
20. Adjust the Current thumbwheel to the value indicated in the cutting chart.
21. Adjust the Motion Delay potentiometer to the value indicated in the cutting chart.

Gas Purge

After changing gas types, the gas lines must be purged in order to ensure that a dangerous gas mixture does not exist. The gas console can be manually purged by setting the Gas Test/Run switch to the three test modes for a minimum of 10 seconds each. NOTE: If the Gas Test/Run switch is not set to test mode after power is restored to the system, the gas console will perform an automatic purge prior to initiating a cut.

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Making a Cut

Once the unit has been properly set up and the x/y machine and height control systems have been properly configured, perform the following steps to cut with the system:

1. Use the x/y machine control to apply a start signal to the system. Upon the reception of a cycle start signal, the following sequence will take place:
   - Two second gas preflow
   - High frequency starting circuit energized
   - Pilot arc initiation
   - Transferred arc (cutting arc) established
   - Motion output relay energized after Pierce Delay timer complete
2. Upon removal of the cycle start signal, the following sequence will take place:
   - Cutting arc extinguished
   - Motion output relay deenergized
   - Gas postflow

Consumable Life

Use the following guidelines to maximize consumable parts life:

1. Use the recommended pierce height given in the cutting charts. A pierce height that is too low will allow molten metal that is ejected during the piercing process to damage the shield cap and nozzle. A pierce height that is too high will cause the pilot arc time to be excessively long and will cause nozzle damage.
2. Make sure the arc extinguishes properly at the end of each cut. Program the lead-out such that the arc is not lost before the lead-out is complete. The arc must remain transferred to the workpiece throughout the turn-off sequence. A "popping" noise can be heard if the arc extinguishes abnormally.
3. Make sure the torch does not touch the plate while cutting. Shield cap and nozzle damage will result.
4. Use a chain cut when possible. Starting and stopping the torch is much more detrimental to the consumables than making a continuous cut.

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Cut Quality

Before the optimum cutting condition can be achieved on a particular material type and thickness, the machine operator must have a thorough understanding of the cutting characteristics of the ProLine system. When the cut quality is not satisfactory, the cutting speed, torch height, or gas pressures may need to be adjusted in small increments until the proper cutting condition is obtained. The following guidelines should be useful in determining which cutting parameter to adjust.

> ***Note: Before making any parameter changes, verify that the torch is square to the workpiece. Also, it is essential to have the correct torch parts in place and to ensure that they are in good condition. Check the electrode for excessive wear and the nozzle and shield cap orifices for roundness. Also, check the parts for any dents or distortions. Irregularities in the torch parts can cause cut quality problems.***

1. A positive cut angle (top dimension of piece smaller than the bottom dimension) usually occurs when the torch standoff distance is too high, when cutting too fast, or when excessive power is used to cut a given plate thickness.
2. A negative cut angle (top dimension of piece larger than the bottom dimension) usually occurs when the torch standoff distance is too low or when the cutting speed is too slow.
3. Top dross usually occurs when the torch standoff distance is too high.
4. Bottom dross usually occurs when the cutting speed is either too slow (slow-speed dross) or too fast (high-speed dross). Low-speed dross is easily removed, while high-speed dross usually requires grinding or chipping off. When using oxygen as the shielding gas, bottom dross can sometimes be removed by increasing the shield gas pressure. However, increasing the shield pressure too much can cause cut face irregularities (see below). Bottom dross also occurs more frequently as the metal heats up. As more pieces are cut out of a particular plate, the more likely they are to form dross.
5. When using oxygen as a shielding gas, cut face irregularities usually indicate that the shield gas pressure is too high or the torch standoff distance is too low.
6. A concave cut face usually indicates that the torch standoff distance is too low or the shield gas pressure is too high. A convex cut face usually indicates that the torch standoff distance is too high or the shield gas pressure is too low.
7. Note that different material compositions have an effect on dross formation.

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Cutting Charts

The cutting charts shown on the following pages are intended to give the operator the best starting point to use when making a cut on a particular material type and thickness. Small adjustments may have to be made to achieve the best cut. Also, remember that the arc voltage must be increased as the electrode wears in order to maintain the correct cutting height.

Cutting Chart Index

Material	Process	Current	Plasma Gas	Shield Gas	Copper Electrode
Mild Steel	Cutting	30 Amps	Oxygen	Oxygen	4-8
Mild Steel	Cutting	50 Amps	Oxygen	Oxygen or Air	4-9
Mild Steel	Cutting	70 Amps	Oxygen	Air	4-10
Mild Steel	Cutting	100 Amps	Oxygen	Air	4-11
Mild Steel	Cutting	150 Amps	Oxygen	Air	4-12
Stainless Steel	Cutting	30 Amps	Air	Air	4-13
Stainless Steel	Cutting	50 Amps	Air	Nitrogen	4-14
Stainless Steel	Cutting	70 Amps	H17	Nitrogen	4-15
Stainless Steel	Cutting	70 Amps	Air	Nitrogen	4-16
Stainless Steel	Cutting	100 Amps	H17	Nitrogen	4-17
Stainless Steel	Cutting	100 Amps	Air	Nitrogen	4-18
Stainless Steel	Cutting	150 Amps	H17	Nitrogen	4-19
Stainless Steel	Cutting	150 Amps	Air	Nitrogen	4-20
Aluminum	Cutting	30 Amps	Air	Nitrogen	4-21
Aluminum	Cutting	50 Amps	Air	Nitrogen	4-22
Aluminum	Cutting	70 Amps	Air	Nitrogen	4-23
Aluminum	Cutting	100 Amps	Air	Nitrogen	4-24
Aluminum	Cutting	150 Amps	Air	Nitrogen	4-25
Mild Steel	Marking	10 Amps	Nitrogen	Nitrogen	4-26
Stainless Steel	Marking	10 Amps	Nitrogen	Nitrogen	4-26
Aluminum	Marking	10 Amps	Nitrogen	Nitrogen	4-27

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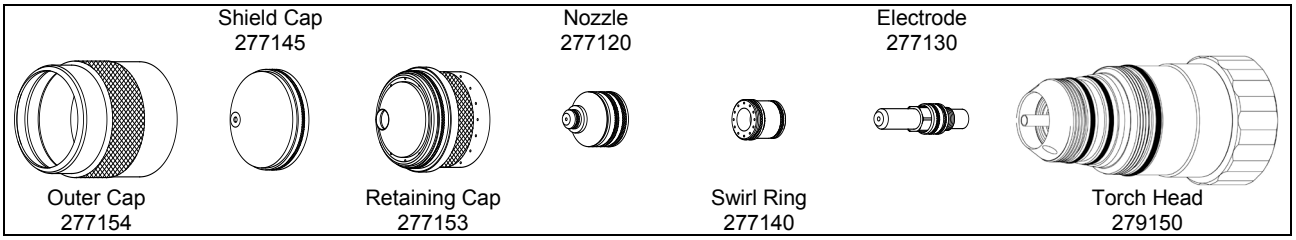
Mild Steel - 30 Amps – Oxygen Plasma / Oxygen Shield
Copper Electrode



Imperial

Material Thickness		Preflow Air	Plasma Oxygen	Shield Oxygen	Postflow Air	Arc Voltage	Travel Speed	Cutting Height	Pierce Height	Pierce Time	Kerf Width
(ga)	(in)	(psi)	(psi)	(psi)	(psi)	(volts)	(ipm)	(in)	(in)	(msec)	(in)
20	.036	35	85	6	2	120	105	.080	.110	100	.062
18	.048					121	97	.090			
16	.060					125	78	.105		200	.065
14	.075					126	65				
12	.105					127	55				.070
11	.120					129	50	.120	.125	300	
10	.135					131	40				

Metric

Material Thickness	Preflow Air	Plasma Oxygen	Shield Oxygen	Postflow Air	Arc Voltage	Travel Speed	Cutting Height	Pierce Height	Pierce Time	Kerf Width
(mm)	(psi)	(psi)	(psi)	(psi)	(volts)	(mm/m)	(mm)	(mm)	(msec)	(mm)
1	35	85	6	2	120	2615	2.0	2.8	100	1.6
1.5					124	2020	2.6		200	1.7
2					126	1615	2.7			
2.5						1455				1.8
3					128	1285	2.9	3.1	300	

1. Revised on 01/18/2011

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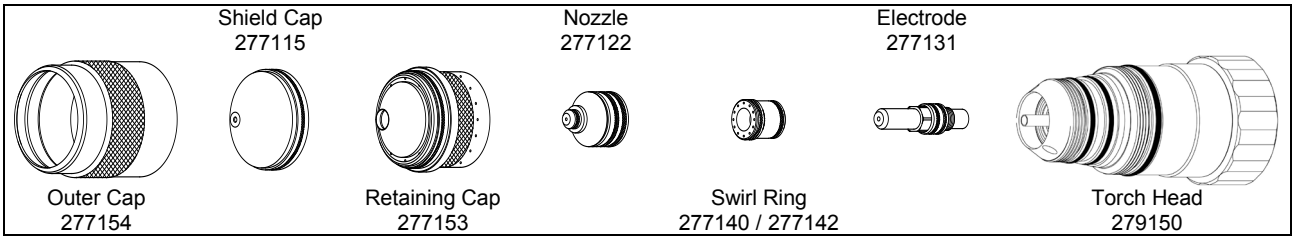
Mild Steel - 50 Amps – Oxygen Plasma / Oxygen or Air Shield
Copper Electrode



Imperial

Material Thickness (ga)	Material Thickness (in)	Preflow Air (psi)	Plasma Oxygen (psi)	Shield O_2 or Air (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
Cold-Rolled Steel – Oxygen Shield – Swirl Ring 277140											
12	.105	25	74	12	1	123	70	.120	.135	100	.075
11	.120					126	60	.125		200	.078
10	.135					128	50	.135			
Hot-Rolled Steel – Air Shield – Swirl Ring 277142											
14	.075	25	74	19	1	106	200	.100	.135	100	.075
12	.105						190				
	.125						180			200	.080
10	.135					110	170	.110			
	3/16					113	105	.140	.200	300	.085
	1/4					117	75		.225	400	.087

Metric

Material Thickness (mm)	Preflow Air (psi)	Plasma Oxygen (psi)	Shield O_2 or Air (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
Cold-Rolled Steel – Oxygen Shield – Swirl Ring 277140										
2.5	25	74	12	1	121	1895	2.9	3.4	100	1.9
3					125	1555	3.1		200	2.0
Hot-Rolled Steel – Air Shield – Swirl Ring 277142										
2.5	25	74	19	1	106	4885	2.5	3.4	100	1.9
3						4660			200	2.0
5					113	2555	3.6	5.1	400	2.2
6					116	2075		5.5		

1. Revised on 01/18/2011

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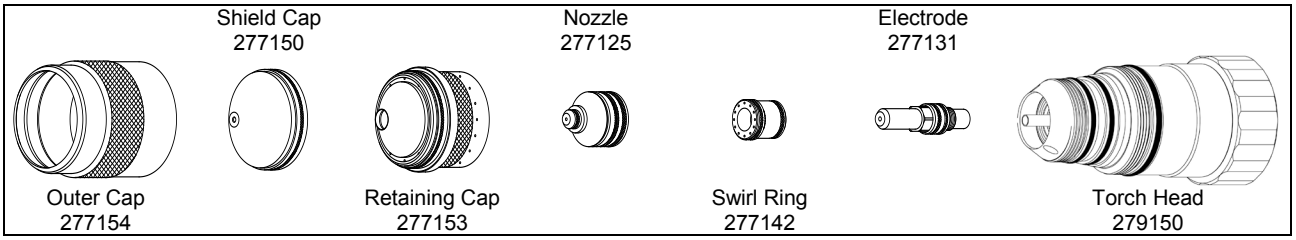
Mild Steel - 70 Amps – Oxygen Plasma / Air Shield
Copper Electrode



Imperial

Material Thickness (in)	Preflow Air (psi)	Plasma Oxygen (psi)	Shield Air (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
1/8	25	80	35	2	110	190	.100	.150	100	.080
3/16			40		113	130		.200	200	
1/4					116	120	.110	.225	300	.085
3/8					122	75	.140	.250	400	

Metric

Material Thickness (mm)	Preflow Air (psi)	Plasma Oxygen (psi)	Shield Air (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
3	25	80	35	2	109	4995	2.5	3.6	100	2.0
5			40		113	3265		5.1	300	
6					115	3105	2.7	5.5		2.2

1. Revised on 01/18/2011

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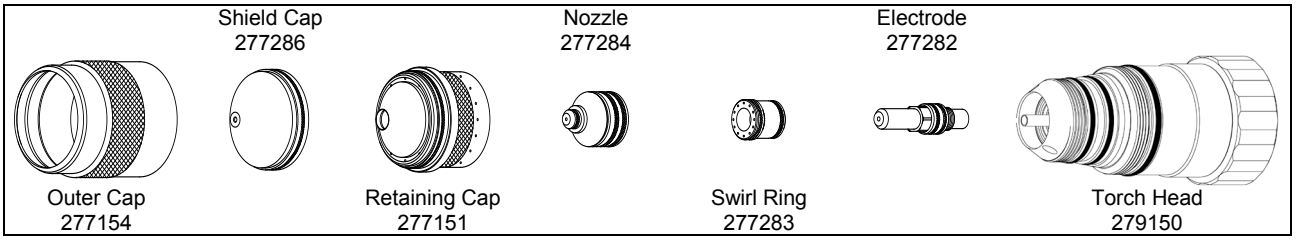
Mild Steel - 100 Amps – Oxygen Plasma / Air Shield
Copper Electrode



Imperial

Material Thickness (in)	Preflow Air (psi)	Plasma Oxygen (psi)	Shield Air (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
1/4	25	94	26	0	125	150	.090	.200	300	.090
3/8					130	100	.130	.250	400	
1/2						65	.155	.300	500	
5/8					143	47	.185	.325	800	.095
3/4					145	35		.350	1000	

Metric

Material Thickness (mm)	Preflow Air (psi)	Plasma Oxygen (psi)	Shield Air (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
6	25	94	26	0	124	3950	2.1	4.9	300	2.3
10					130	2405	3.3	6.5	500	
12						1850	3.7	7.3		
16					143	1180	4.7	8.3	1000	2.4
20					145	800		9.0		

* Use an arc transfer height (ignition height) of .200" (4.9 mm)
1. Revised on 01/18/2011

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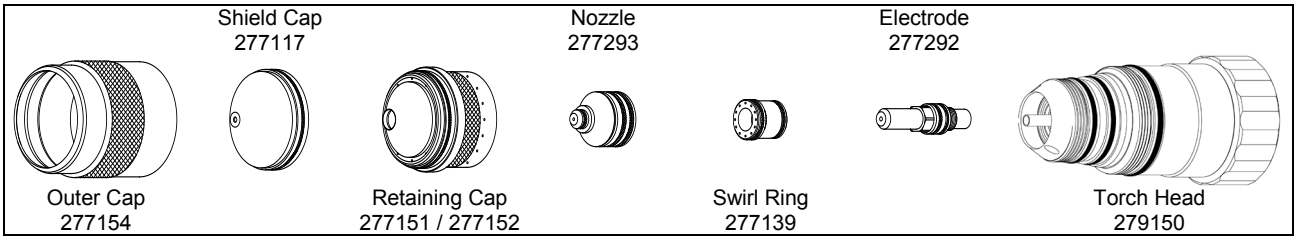
Mild Steel - 150 Amps – Oxygen Plasma / Air Shield
Copper Electrode



Imperial

Material Thickness (in)	Preflow Air (psi)	Plasma Oxygen (psi)	Shield Air (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
Retaining Cap 277151										
1/4	20	74	30	0	118	165	.105	.200	300	.125
3/8					123	125	.135	.250	400	
1/2					125	90	.140	.300	500	.130
Retaining Cap 277152										
5/8	20	74	45	0	127	70	.140	.325	600	.130
3/4					130	55		.350	1000	.135
1					134	40	.150	.400	1500	.140
1.25 **					145	25	.200	.350		
1.5 **					155	15	.225			

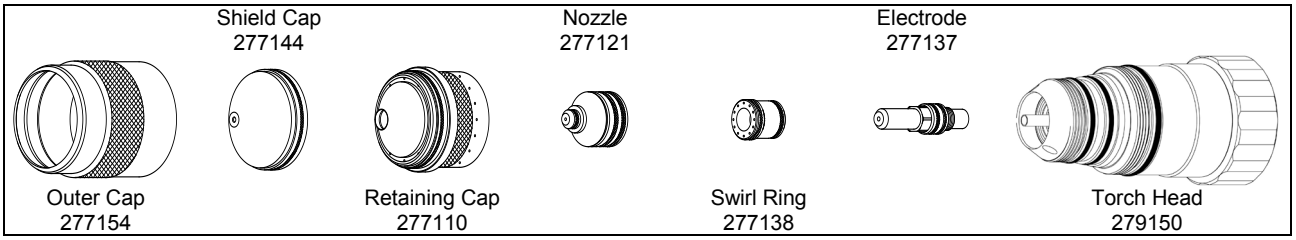
Metric

Material Thickness (mm)	Preflow Air (psi)	Plasma Oxygen (psi)	Shield Air (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
Retaining Cap 277151										
6	20	74	30	0	117	4305	2.6	4.9	300	3.2
10					123	3040	3.4	6.5	500	
12					124	2485	3.5	7.3		3.3
Retaining Cap 277152										
16	20	74	45	0	127	1760	3.6	8.3	1000	3.3
20					130	1340		9.0	1500	3.4
25					133	1040	3.7	10.1		3.6
32 **					145	625	5.1	8.9		
38 **					154	385	5.6	8.9		

* Use an arc transfer height (ignition height) of .200" (4.9 mm)
** Edge start recommended
1. Revised on 01/18/2011

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Stainless Steel - 30 Amps – Air Plasma / Air Shield
Copper Electrode



Imperial

Material Thickness		Preflow Air	Plasma Air	Shield Air	Postflow Air	Arc Voltage	Travel Speed	Cutting Height	Pierce Height	Pierce Time	Kerf Width
(ga)	(in)	(psi)	(psi)	(psi)	(psi)	(volts)	(ipm)	(in)	(in)	(msec)	(in)
20	.036	30	80	30	14	71	200	.020	.050	100	.065
18	.048						165	.035			
16	.060					74	125			200	.068
14	.075					75	90	.025			.070

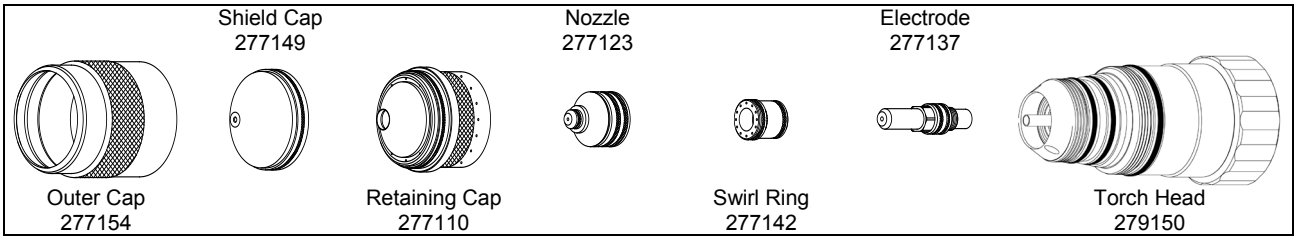
Metric

Material Thickness	Preflow Air	Plasma Air	Shield Air	Postflow Air	Arc Voltage	Travel Speed	Cutting Height	Pierce Height	Pierce Time	Kerf Width
(mm)	(psi)	(psi)	(psi)	(psi)	(volts)	(mm/m)	(mm)	(mm)	(msec)	(mm)
1	30	80	30	14	71	4855	0.6	1.3	100	1.7
1.5					73	3260	0.9		200	

* Use an arc transfer height (ignition height) of .050" (1.3 mm)
1. Revised on 01/18/2011

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Stainless Steel - 50 Amps – Air Plasma / Nitrogen Shield
Copper Electrode



Imperial

Material Thickness (ga)	Material Thickness (in)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
14	.075	30	70	40	4	87	105	.035	.070	100	.105
12	.105					88	75				
11	.120					89	65			200	
10	.135					90	55				.110
	3/16					94	50	.040	.080	300	
	1/4					100	40	.060	.125	400	.115

Metric

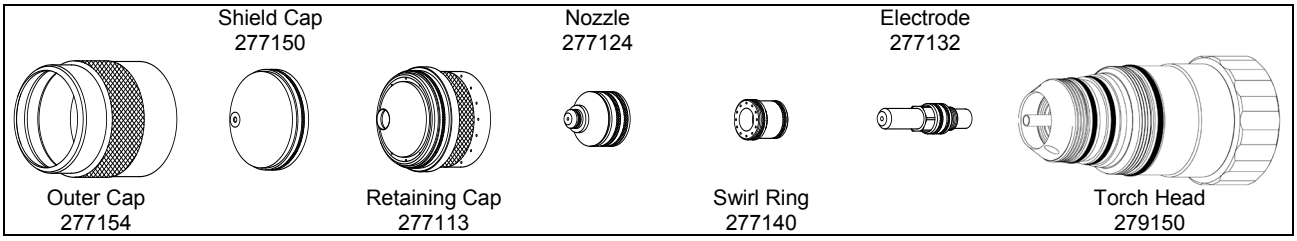
Material Thickness (mm)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
2	30	70	40	4	87	2565	.9	1.8	100	2.7
2.5						2080				
3					88	1685			200	
5					94	1235	1.0	2.1	400	2.8
6					98	1075	1.3	2.9		2.9

* Use an arc transfer height (ignition height) of .070" (1.8 mm)
1. Revised on 01/18/2011

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Stainless Steel - 70 Amps – H17 Plasma / Nitrogen Shield
Copper Electrode

This gas combination gives the best cut quality and minimum dross levels



Imperial

Material Thickness (in)	Preflow Nitrogen (psi)	Plasma H17 (psi)	Shield Nitrogen (psi)	Postflow Nitrogen (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
3/16	35	60	36	13	135	80	.100	.200	300	.090

Metric

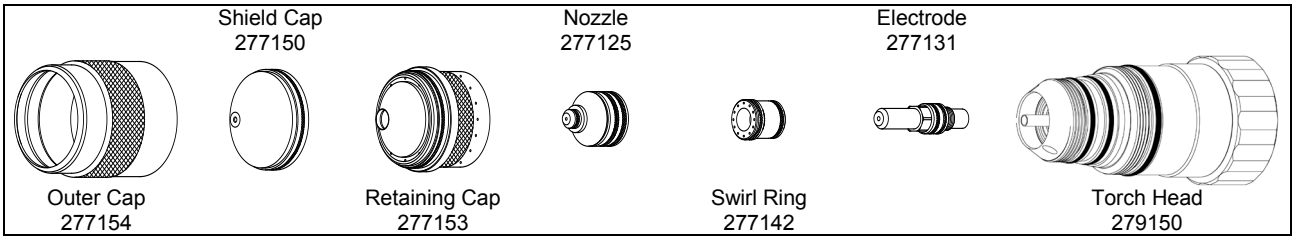
Material Thickness (mm)	Preflow Nitrogen (psi)	Plasma H17 (psi)	Shield Nitrogen (psi)	Postflow Nitrogen (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
5	35	60	36	13	135	2030	2.5	5.1	300	2.3

H17=17.5% Hydrogen / 32.5% Argon / 50.0% Nitrogen
* Use an arc transfer height (ignition height) of .150" (3.8 mm)
1. Revised on 01/18/2011

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Stainless Steel - 70 Amps – Air Plasma / Nitrogen Shield
Copper Electrode

This gas combination gives medium cut quality and minimum dross levels



Imperial

Material Thickness (ga)	Material Thickness (in)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
10	.135	25	80	25	2	132	120	.060	.150	200	.085
	3/16					134	100	.070	.200	300	
	1/4					140	75	.090	.225	400	.090
	3/8					148	50	.120	.250	500	

Metric

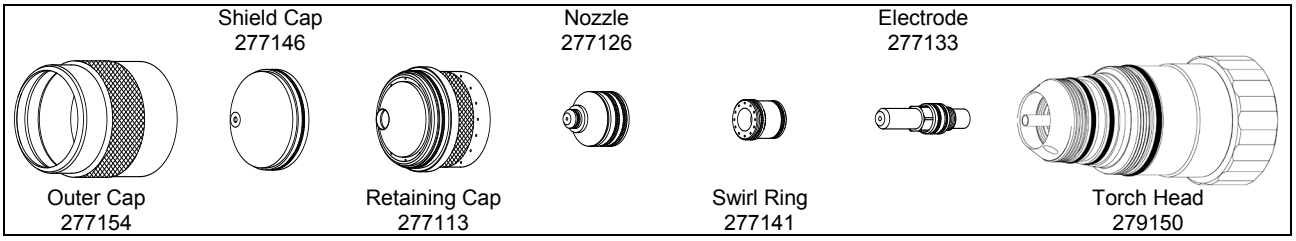
Material Thickness (mm)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
3	25	80	25	2	131	3210	1.4	3.3	200	2.2
5					134	2445	1.8	5.1	400	
6					138	2050	2.1	5.5		2.3

* Use an arc transfer height (ignition height) of .150" (3.3 mm)
1. Revised on 01/18/2011

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Stainless Steel - 100 Amps – H17 Plasma / Nitrogen Shield
Copper Electrode

This gas combination gives the best cut quality and minimum dross levels



Imperial

Material Thickness (in)	Preflow Nitrogen (psi)	Plasma H17 (psi)	Shield Nitrogen (psi)	Postflow Nitrogen (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
3/16	28	67	46	13	138	115	.105	.200	300	.100
1/4					140	100	.125	.225	400	.105
3/8					152	65	.180	.250	500	

Metric

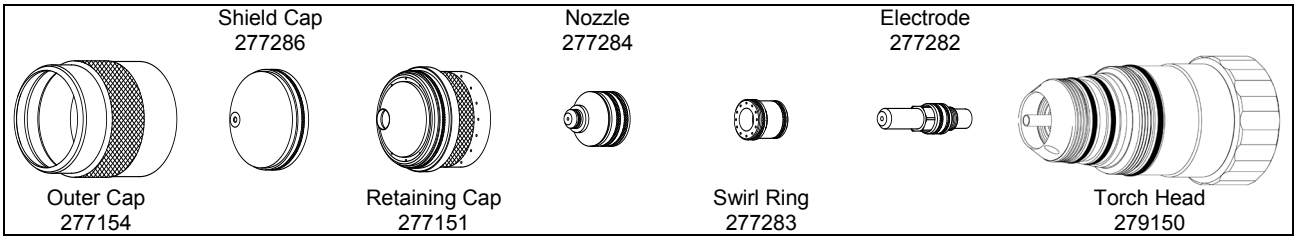
Material Thickness (mm)	Preflow Nitrogen (psi)	Plasma H17 (psi)	Shield Nitrogen (psi)	Postflow Nitrogen (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
5	28	67	46	13	138	2865	2.7	5.1	400	2.5
6					139	2625	3.0	5.5		2.7

H17=17.5% Hydrogen / 32.5% Argon / 50.0% Nitrogen
* Use an arc transfer height (ignition height) of .200" (5.1 mm)
1. Revised on 01/18/2011

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Stainless Steel - 100 Amps – Air Plasma / Nitrogen Shield
Copper Electrode

This gas combination gives medium cut quality and minimum dross levels



Imperial

Material Thickness (in)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
1/4	25	94	35	0	141	100	.135	.225	400	.092
3/8					147	80	.170	.250	500	.095
1/2					154	55	.210	.300	600	

Metric

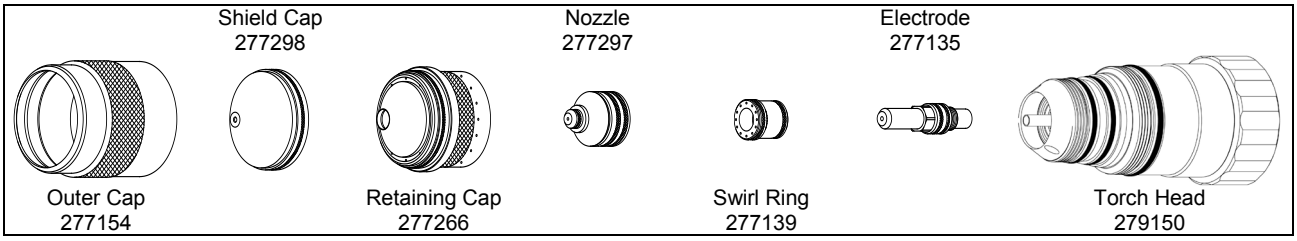
Material Thickness (mm)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
6	25	94	35	0	140	2595	3.2	5.6	400	2.3
10					148	1935	4.4	6.5	600	2.4
12					152	1540	5.0	7.3		

* Use an arc transfer height (ignition height) of .200" (5.1 mm)
1. Revised on 01/18/2011

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Stainless Steel - 150 Amps – H17 Plasma / Nitrogen Shield
Copper Electrode

This gas combination gives the best cut quality and minimum dross levels



Imperial

Material Thickness (in)	Preflow Nitrogen (psi)	Plasma H17 (psi)	Shield Nitrogen (psi)	Postflow Nitrogen (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
1/4	25	81	75	13	165	95	.250	.250	400	.135
3/8						75	.150	.275	500	
1/2						60	.165	.300	600	.140
5/8						50	.185	.325	800	
3/4						40	.250	.350	1200	.145

Metric

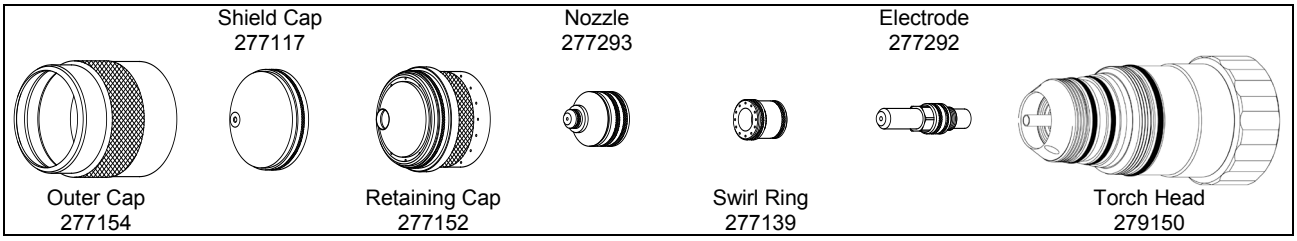
Material Thickness (mm)	Preflow Nitrogen (psi)	Plasma H17 (psi)	Shield Nitrogen (psi)	Postflow Nitrogen (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
10	25	81	75	13	155	1845	3.8	7.0	600	3.4
12						1610	4.1	7.4		3.6
16						1260	4.7	8.3	800	
20					167	940	6.9	9.0	1200	3.7

H17=17.5% Hydrogen / 32.5% Argon / 50.0% Nitrogen
* Use an arc transfer height (ignition height) of .200" (5.1 mm)
1. Revised on 01/18/2011

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Stainless Steel - 150 Amps – Air Plasma / Nitrogen Shield
Copper Electrode

This gas combination gives medium cut quality and minimum dross levels



Imperial

Material Thickness (in)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
1/4	25	75	70	0	145	150	.160	.250	400	.125
3/8					150	115	.180	.275	500	
1/2					155	85	.210	.300	600	.130
5/8					160	60	.220	.325	800	
3/4					168	45	.240	.350	1200	.135

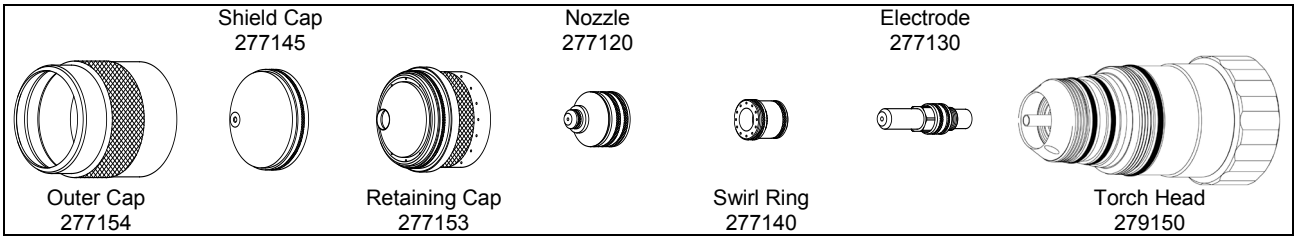
Metric

Material Thickness (mm)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
6	25	75	70	0	144	3910	4.0	6.3	400	3.2
10					150	2805	4.7	7.0	600	
12					153	2330	5.1	7.4		3.3
16					160	1510	5.6	8.3	800	
20					170	1030	6.2	9.0	1200	3.4

* Use an arc transfer height (ignition height) of .200" (5.1 mm)
1. Revised on 01/18/2011

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Aluminum - 30 Amps – Air Plasma / Nitrogen Shield
Copper Electrode



Imperial

Material Thickness (in)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
.040	30	92	20	2	135	150	.030	.100	100	.065
.050						120				
.063						90		.150	200	.070

Metric

Material Thickness (mm)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
1	30	92	20	2	135	3885	0.8	2.5	100	1.7
1.5						2520		3.4	200	1.8

* Use an arc transfer height (ignition height) of .100" (2.5 mm)
1. Revised on 01/18/2011

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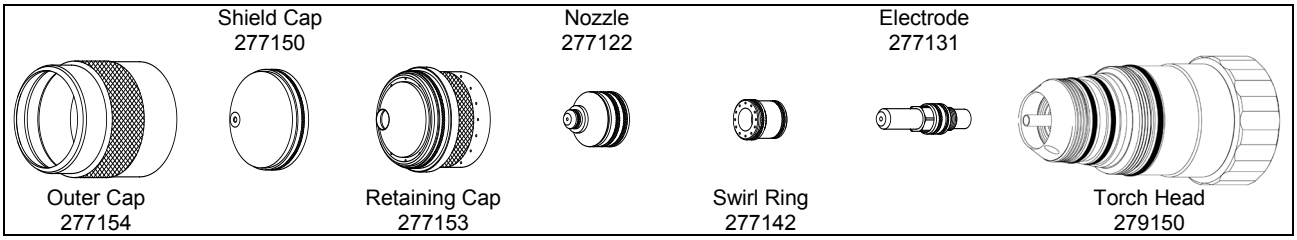
Aluminum - 50 Amps – Air Plasma / Nitrogen Shield
Copper Electrode



Imperial

Material Thickness (in)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
.050	25	74	19	1	135	180	.050	.100	100	.080
.063					138	140	.065		150	.082
.080					143	90	.075	.150	200	.085

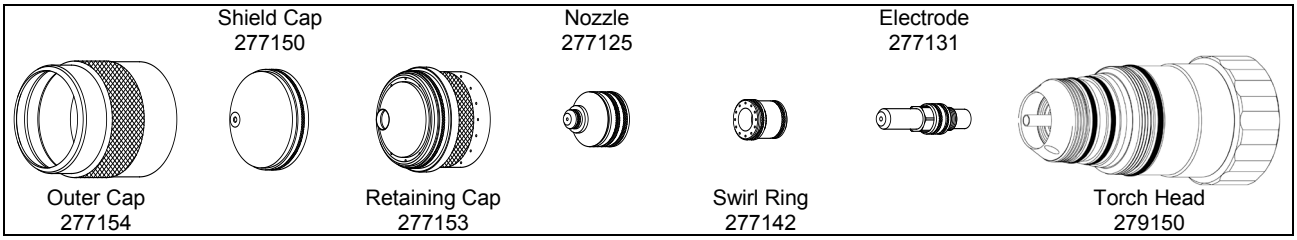
Metric

Material Thickness (mm)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
1.5	25	74	19	1	137	3870	1.5	2.5	150	2.1
2.0					142	2360	1.8	3.7	200	2.2

* Use an arc transfer height (ignition height) of .100" (2.5 mm)
1. Revised on 01/18/2011

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Aluminum - 70 Amps – Air Plasma / Nitrogen Shield
Copper Electrode



Imperial

Material Thickness (in)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
.080	25	80	25	2	130	250	.050	.150	100	.080
1/8					135	160	.070	.175		
3/16					145	80	.100	.200	200	.085
1/4					150	50	.060	.250	300	
3/8					155	40	.075	.275	400	.090
1/2					162	30	.115	.300	500	

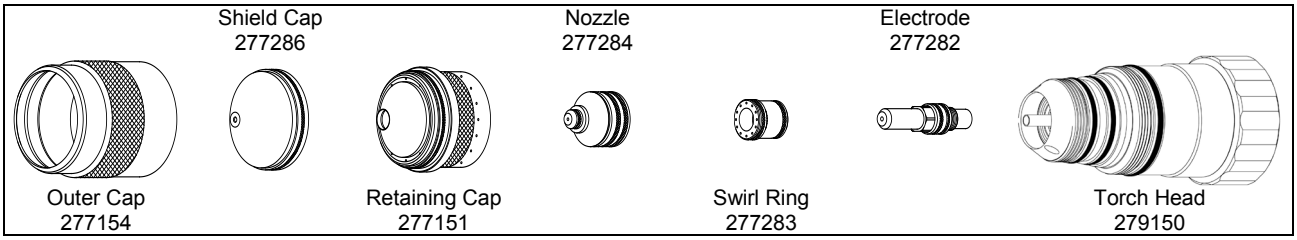
Metric

Material Thickness (mm)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
2	25	80	25	2	129	6400	1.2	3.7	100	2.0
3					134	4420	1.7	4.3		
5					145	1920	2.3	5.2	300	2.2
6					148	1440	1.7	6.1		
10					156	975	2.0	7.0	500	2.3
12					160	820	2.6	7.4		

* Use an arc transfer height (ignition height) of .150" (3.7 mm)
1. Revised on 01/18/2011

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Aluminum - 100 Amps – Air Plasma / Nitrogen Shield
Copper Electrode



Imperial

Material Thickness (in)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
1/4	25	94	26	0	158	105	.155	.250	300	.095
3/8					162	90	.180	.275	400	.098
1/2					165	70	.195	.300	500	.100

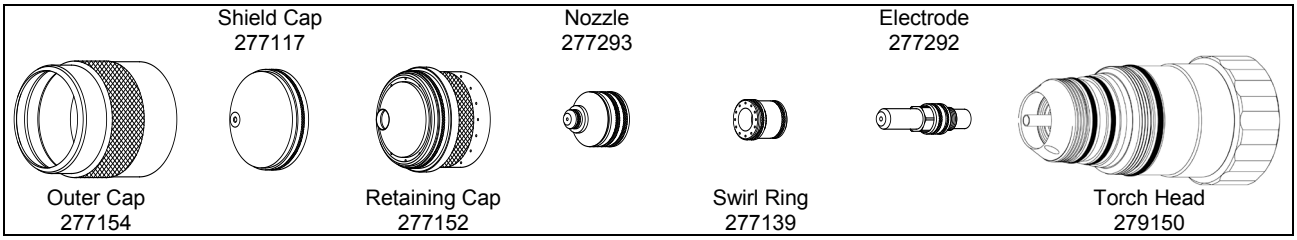
Metric

Material Thickness (mm)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
6	25	94	26	0	158	2710	3.8	6.3	300	2.4
10					162	2210	4.6	7.0	500	2.5
12					165	1890	4.9	7.4		

* Use an arc transfer height (ignition height) of .250" (6.3 mm)
1. Revised on 01/18/2011

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Aluminum - 150 Amps – Air Plasma / Nitrogen Shield
Copper Electrode



Imperial

Material Thickness (in)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Cutting Height (in)	Pierce Height (in)	Pierce Time (msec)	Kerf Width (in)
1/4	25	75	50	1	145	145	.130	.250	400	.125
3/8					155	115	.185	.275	500	
1/2					165	90	.230	.300	600	.130
5/8					170	65	.250	.325	800	.135
3/4						45		.350	1200	.140

Metric

Material Thickness (mm)	Preflow Air (psi)	Plasma Air (psi)	Shield Nitrogen (psi)	Postflow Air (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Cutting Height (mm)	Pierce Height (mm)	Pierce Time (msec)	Kerf Width (mm)
6	25	75	50	1	143	3770	3.1	6.3	400	3.2
10					156	2825	4.8	7.0	600	
12					162	2430	5.5	7.4		3.3
16					170	1630	6.4	8.3	1200	3.4
20					170	990		9.0		3.6

* Use an arc transfer height (ignition height) of .250" (6.3 mm)
1. Revised on 01/18/2011

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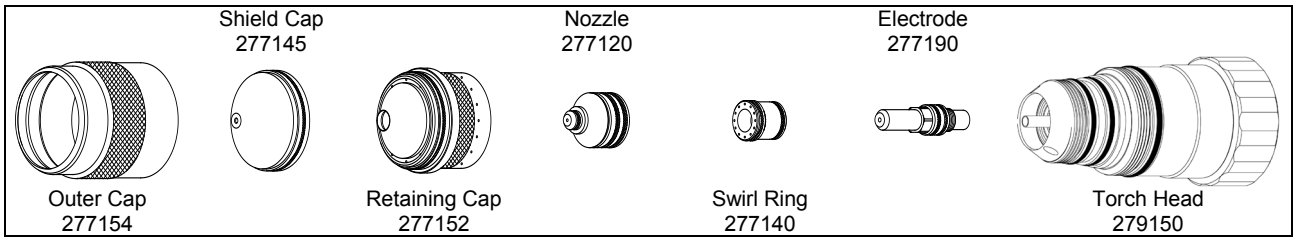
Mild Steel Marking - 10 Amps – Nitrogen Plasma / Nitrogen Shield Copper Electrode



Imperial

Material Thickness (in)	Preflow (Air) (psi)	Plasma (Nitrogen) (psi)	Shield (Nitrogen) (psi)	Postflow (Air) (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Marking Height (in)	Initial Height (in)	Pierce Time (msec)
All Thicknesses	28	28	28	2	145	250	.177	.100	0

Metric

Material Thickness (mm)	Preflow (Air) (psi)	Plasma (Nitrogen) (psi)	Shield (Nitrogen) (psi)	Postflow (Air) (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Marking Height (mm)	Initial Height (mm)	Pierce Time (msec)
All Thicknesses	28	28	28	2	145	6350	4.5	2.5	0

1. Revised on 10/12/07

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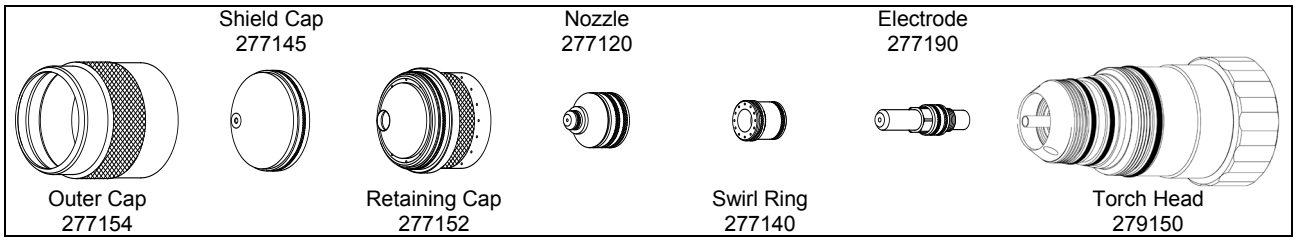
Stainless Steel Marking - 10 Amps – Nitrogen Plasma / Nitrogen Shield Copper Electrode



Imperial

Material Thickness (in)	Preflow (Air) (psi)	Plasma (Nitrogen) (psi)	Shield (Nitrogen) (psi)	Postflow (Air) (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Marking Height (in)	Initial Height (in)	Pierce Time (msec)
All Thicknesses	28	28	28	2	145	250	.177	.100	0

Metric

Material Thickness (mm)	Preflow (Air) (psi)	Plasma (Nitrogen) (psi)	Shield (Nitrogen) (psi)	Postflow (Air) (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Marking Height (mm)	Initial Height (mm)	Pierce Time (msec)
All Thicknesses	28	28	28	2	145	6350	4.5	2.5	0

1. Revised on 10/12/07

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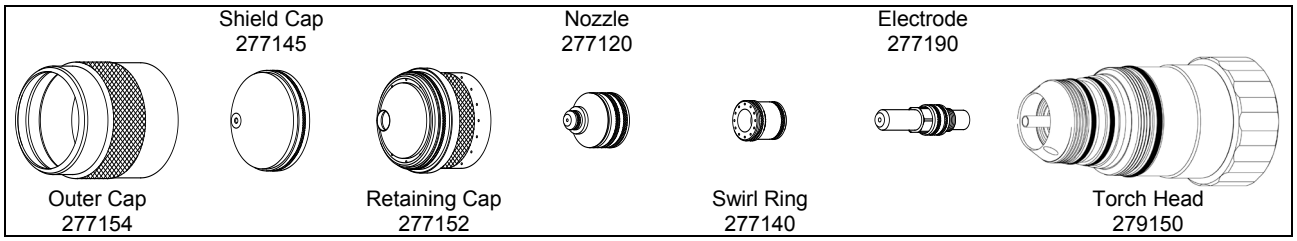
Aluminum Marking - 10 Amps – Nitrogen Plasma / Nitrogen Shield Copper Electrode



Imperial

Material Thickness (in)	Preflow (Air) (psi)	Plasma (Nitrogen) (si)	Shield (Nitrogen) (psi)	Postflow (Air) (psi)	Arc Voltage (volts)	Travel Speed (ipm)	Marking Height (in)	Initial Height (in)	Pierce Time (msec)
All Thicknesses	28	28	28	2	145	250	.177	.100	0

Metric

Material Thickness (mm)	Preflow (Air) (psi)	Plasma (Nitrogen) (psi)	Shield (Nitrogen) (psi)	Postflow (Air) (psi)	Arc Voltage (volts)	Travel Speed (mm/m)	Marking Height (mm)	Initial Height (mm)	Pierce Time (msec)
All Thicknesses	28	28	28	2	145	6350	4.5	2.5	0

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Section 5 Maintenance and Troubleshooting

WARNING: Only qualified maintenance personnel should perform maintenance on the ProLine system. The system utilizes potentially fatal A.C. and D.C. voltages. All maintenance should be performed with safety in mind.
Use extreme caution when working near the power conversion module (i.e., chopper). The large electrolytic capacitors store large amounts of energy even after power has been removed from the system. Wait at least five minutes after turning off power, and then use a voltmeter to verify that the capacitors are fully discharged before touching the power conversion module.
Capacitor failure can injure and/or cause property damage. If troubleshooting requires the system to be powered with the enclosure panels removed, remain clear of the capacitors. Failure of a capacitor can result in a sudden release of stored energy causing rupture of the capacitor case.

Routine Maintenance

Note: At minimum, these checks should be performed on a monthly basis. In excessively dirty environments or in heavy usage situations, the checks should be performed more frequently.

Power Supply

1. Remove the left, right, front, and rear panels of the power supply.
2. Using clean, dry, compressed air, blow out all accumulated dust inside the power supply, including dust on p.c. boards and fans. Be sure to blow out the fan and heat exchanger at the rear of the unit. In an excessively dirty environment, blow out the unit on a weekly basis.
3. Verify that all torch lead and work ground connections are secure and free from corrosion.
4. Verify that the primary three phase A.C. voltage connections are tight
5. Verify that all p.c. board connectors are installed securely.
6. Verify that the rear panel cable connectors are installed securely.
7. Verify that the gas console connectors are installed securely to the plugs on the bottom of the gas console.
8. Check the torch coolant filter/deionization cartridge at the rear of the power supply and replace if dirty.
9. Flush the cooling system every six months and replace the coolant and coolant filter/deionization cartridge.

Gas Console

1. Remove the cover of the gas console.
2. Using clean, dry, compressed air, blow out all accumulated dust inside the unit. In an excessively dirty environment, blow out the unit on a weekly basis.
3. Verify that all p.c. board connectors are installed securely.
4. Verify that all gas hose connectors are tight and that there are no leaks. ***Only tighten the gas fittings enough to make a gas seal. The fittings are subject to damage if over tightened***.
5. Inspect all gas hoses to ensure no damage exists. Immediately replace any damaged gas hoses.

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Torch, Torch Leads, and Gas Hoses

1. Verify that all torch lead and gas hose connections are tight and that there are no gas or water leaks. ***Only tighten the fittings enough to make a water or gas seal. The fittings are subject to damage if over tightened***.
2. Verify that the braided shield of the torch leads is fastened securely to the brass shield adapter that connects to the remote high frequency console. Also, make sure the shield adapter is secured tightly to the high frequency console enclosure.
3. Inspect the braided shield for nicks or cuts and replace if necessary.
4. Remove the torch handle and verify that the connections at the torch base are tightened securely. ***Only tighten the fittings enough to make a water or gas seal. The fittings are subject to damage if over tightened***.
5. Make sure the torch lead insulating sleeves are positioned to properly cover the brass torch fittings at the rear of the torch base.
6. Inspect the outer sleeve on the torch base's electrode/coolant supply lead. If nicks, cuts or holes are found, replace the torch base.
7. Remove the torch consumables from the torch head and inspect the o-rings on the torch base. Replace any o-rings with cuts, nicks, abrasions, or any other signs of wear. Faulty o-rings may cause gas or water leaks, which will affect cut quality.
8. With the electrode removed, inspect the cooling tube in the torch head for damage. For a copper electrode, the torch head uses cooling tube P/N 277007. If replacement is required, use tool P/N 200109.
9. Wipe any excess o-ring lubricant off of the torch base and head.

Remote High Frequency Console

1. Open the cover of the RHF console and verify that all leads and hoses are tightened securely. **Only tighten the fittings enough to make a water or gas seal. The fittings are subject to damage if over tightened**.
2. Check the spark gap electrodes for signs of wear. Replace electrodes that have rounded faces. Use a clean feeler gauge and set the spark gap to .015" (.38 mm).

Work Ground

1. Verify that the work ground lead is securely fastened to the star ground on the cutting table, and that the connection point is free from corrosion. Use a wire brush to clean the connection point if necessary.

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Replacing the Torch Coolant

The torch coolant should be flushed out of the system every six months and replaced with new coolant. The following procedure should be used to prevent damage to the cooling system.

Note: When handling coolant, it is recommended that you wear nitrile gloves and safety glasses.

1. Remove primary power to the system.

2. Remove the rear cover of the power supply to expose the cooling system.

3. Remove the coolant reservoir cap/level gauge.

4. Make sure that consumables are properly installed in the torch head and that the torch head is installed on the torch base.

5. **Using a funnel to collect the coolant,** unscrew the drain petcock on the bottom of the coolant reservoir. Leave the funnel in place after the coolant drains out of the reservoir.

6. Remove the torch coolant supply hose from the rear of the power supply. Note that the coolant supply hose has right hand threads.

7. Blow compressed air (100 psi maximum) into the coolant supply hose. This will clear the coolant out of the torch, torch leads, and heat exchanger. Note that the coolant will be forced into the reservoir and will drain out of the drain petcock.

8. Unscrew the lower portion of the coolant filter housing and remove the coolant filter/deionization cartridge.

9. Reconnect the coolant hoses and replace the coolant and coolant filter/deionization cartridge. **Only use Kaliburn approved torch coolant solution**. Commercially available antifreeze contains corrosion inhibitors that will damage the cooling system. See Section 3 for more information on torch coolant requirements.

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Microprocessor Status LED's

The microprocessor p.c. board controls all of the functions of the ProLine system. It has 31 LED's which aid in troubleshooting the system. The LED's illuminate when a particular event occurs. Illuminated LED's indicate the following:

LED	Indication
LED 1 PAR	Pilot arc relay energized
LED 2 CON	Main contactor energized
LED 3 SURGE	CR3 and K1 (I/O p.c. board) relays energized
LED 4 PREFLOW	Preflow gas valve 1 energized
LED 5 LATCH	Latch relay on the relay p.c. board energized
LED 6 AUX2 OUT	Shield gas valve GSV3 energized
LED 7 PUMP	Coolant pump relay CR5 energized
LED 8 START	Plasma start signal applied to ProLine
LED 9 CHOPPER	Chopper energized
LED 10 PAT	Pilot arc transistor energized
LED 11 TAC	Transferred arc established from torch to workpiece
LED 12 MOTION	Motion relay energized
LED 13 HOLD IN	Arc hold input or IHS hold input enabled to keep arc from igniting
LED 14 HOLD OUT	Hold relay energized / used for dual power supply mode
LED 15 MAN CONSOLE	Manual gas console attached
LED 16 5V uP PWR	5V microprocessor power supply satisfactory
LED 17 12V uP PWR	12V microprocessor power supply satisfactory
LED 18 ILK PWR	12V interlock power supply satisfactory
LED 19 ANALOG PWR	15V analog power satisfactory
LED 20 GAS PWR	24V gas solenoid power satisfactory
LED 21 OVER CURRENT	Current output exceeded 150 amps / power down to reset
LED 22 ERROR	Blinks on and off to display error codes
LED 23 GSV4	Postflow gas valve 4 energized
LED 24 PLASMA	Plasma gas valve 2 energized
LED 25 AUX OUT	Auxiliary output energized
LED 26 3 PHASE	Correct three phase power applied to chopper
LED 27 HIGH FREQ	High frequency transformer TR5 energized
LED 29 –15V	-15V analog power satisfactory

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Microprocessor Sequence of Operation

The following LED's should illuminate after primary power is applied:

- LED 16 5V uP PWR
- LED 17 12V uP PWR
- LED 18 ILK PWR
- LED 19 ANALOG PWR
- LED 20 GAS PWR
- LED 29 –15V

The following LED's should illuminate when the ON button is depressed:

- LED 26 3 PHASE
- LED 7 PUMP
- LED 5 LATCH

The following LED's should illuminate in sequence after a start signal is received:

- LED 8 START
- LED 4 PREFLOW
- LED 6 AUX2 OUT
- LED 14 HOLD OUT
- LED 2 CON
- LED 9 CHOPPER
- LED 1 PAR
- LED 10 PAT
- LED 27 HIGH FREQ
- LED 11 TAC
- LED 24 PLASMA
- LED 12 MOTION

After a transferred cutting arc is established, the following LED's will go out:

- LED 14 HOLD OUT
- LED 27 HIGH FREQ
- LED 4 PREFLOW
- LED 10 PAT

When the start signal is removed, all of the cut cycle LED's will extinguish except for LED 23 GSV4, which will illuminate for approximately 3 seconds and then go out.

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Troubleshooting Using the Control Panel Status LED's

If the ProLine system develops a problem, first check the control panel status LED's. If one or more of the LED's does not illuminate after the ON button is depressed, use the status LED's to pinpoint the problem.

- **RHF Door LED** - Extinguishes when the RHF door switch opens. Check the RHF door, switch, and associated wiring.
- **Gas Console LED** - Extinguishes when the preflow outlet, plasma outlet, or shield inlet pressures are low.
- **3 Phase Power LED** - Extinguishes when there is a problem with the three phase power being supplied to the chopper assembly. Verify that the primary wall disconnect fuses are good and check the main transformer, main contactor and A.C. Detect p.c. board for proper operation. Also, this LED should turn on immediately when the green "ON" button is pressed. If not, check P28-3 to P28-4 for 10 VDC first. This should drop to 0 VDC when the ON button is pushed. If not, then check CR1 and associated wiring.
- **Coolant Flow LED** - Extinguishes when there is a problem with the torch coolant system. Check the coolant pump fuse F2 and verify that 230VAC is present between TB3-13 and TB3-14. Also check for clogs in the coolant leads and coolant filter/deionization cartridge.
- **Coolant Level LED** - Extinguishes when the coolant level in the tank has dropped below the required minimum level. Add more coolant to clear the error.
- **Coolant Temperature LED** - Extinguishes when the coolant temperature has risen above the maximum operating temperature. Ensure that the heat exchanger fan is running and that the heat exchanger is free from dust. Blow out the heat exchanger and fan with clean, dry, oil-free compressed air. Leave the unit running until the LED illuminates.

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Troubleshooting Using the Microprocessor Error LED

If all of the status LED's are illuminated but the ProLine system still has a problem, remove the front panel of the power supply to gain access to the microprocessor control board. The power supply microprocessor board displays an error code by blinking LED22 on and off to indicate that an error has occurred. The number of blinks can be counted to determine which error has occurred. The following chart lists the errors and the corresponding number of blinks.

LED22 Number of Blinks	Error
1	No transferred arc (TAC) established
2	TAC lost before current slope up
3	TAC lost during current slope up
4	TAC lost while cutting
5	TAC lost during current slope down
6	Start signal applied prematurely or while Gas Test/Run switch is in the Run position
7	Start signal removed prematurely
8	Output voltage below 60V
9	Output voltage above 185V
10	Invalid current set point
11	Current feedback circuit open
12	TAC not established within 2 seconds
13	IHS or arc hold timed out
14	Pilot arc not established
15	Low current during cut
16	TAC sensed when start signal applied
17	Faulty AC phase
18	Low torch coolant flow
19	Gas console error
20	RHF door switch open
21	Low torch coolant level
22	High torch coolant temperature
23	Main contactor shorted
24	N/A
25	Defective Flow Switch

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General Troubleshooting

The following chart lists general troubleshooting guidelines for the ProLine system when the status LED's or the error LED do not give any insight to the particular problem being experienced. Please contact KALIBURN technical support for any issues not covered in this section. Before any tests are performed, make sure that all system fuses are good. The primary system fuse F1 is located on the rear panel of the unit. All of the control fuses are located behind the front panel of the unit beside the microprocessor p.c. board. The automatic gas console fuse is located behind the right side panel of the system. Also check all of the voltage LED's on the system p.c. boards before performing any tests.

Problem	Possible Cause
Front panel white A.C. power light will not illuminate	1. Primary disconnect fuse blown. 2. Fuse F1 or F4 blown. 3. White light or associated wiring bad. 4. Transformer TR2 or associated wiring bad.
Unit will not energize when the ON button is pressed	1. RHF door open. 2. Low coolant level. 3. Fuse F4 blown. 4. Faulty ON switch or associated wiring. The ON switch is normally open. 5. Faulty OFF switch or associated wiring. The OFF switch is normally closed. 6. Relay CR1 coil open.
Power supply will not stay on when the front panel ON button is pressed and released	1. Check the control panel status LED's and troubleshoot accordingly. 2. Faulty latch relay on relay p.c. board. 3. Faulty relay p.c. board. 4. Faulty microprocessor p.c. board. 5. Relay CR1 defective.
No arc at the torch	1. Incorrect torch consumables installed. 2. Incorrect gas pressure settings. 3. Check the control panel status LED's and troubleshoot accordingly. 4. Check the spark gap assembly inside the RHF console for proper arcing after a start signal is applied. Open the RHF door and pull up on the door interlock switch plunger to defeat the interlock. If there is no spark, skip to the next test. 5. Pilot arc resistor PAR or pilot arc transistor PAT is not closing properly. Check the relay for proper operation. Also, check the PAR and PAT LED's on the microprocessor p.c. board and PAT drive p.c. board. 6. Damaged or loose torch lead connections.

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Problem	Possible Cause
	7. Shorted torch or torch leads. Check the continuity between the Electrode lead and the Nozzle lead to make sure they are not shorted. 8. Open torch or torch leads. Check the continuity from the Electrode lead to the torch electrode and the Nozzle lead to the large brass body of the torch.
No spark between the spark gap electrodes	1. Improper spark gap. Set gap to .015" (.381 mm). 2. Worn spark gap electrodes. Clean electrodes with 600 grit sandpaper and regap. Replace electrodes that have a rounded face. 3. Bad high frequency transformer TR5. Check for signs of arcing. 4. Check for 120VAC on the input side of filter FL1 inside the RHF console after a start signal has been given. If 120V is not present, check associated wiring back to the power supply.
The arc will not transfer to the workpiece	1. Loose work ground connection. 2. Pierce height too high. 3. Incorrect, damaged, or worn consumables.
Gas pressures will not adjust properly	1. Wrong consumables installed in torch. 2. Pressure regulator orifice clogged with dirt or debris. Turn off primary power and turn regulator adjustment knob fully clockwise.
Low pressure error	1. Supply gas pressure(s) less than 150 psi. 2. Faulty pressure switch or associated wiring inside gas console.

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Chopper Test Procedure

Warning: Only qualified maintenance personnel should perform the chopper test procedure. The system utilizes potentially fatal A.C. and D.C. voltages. All maintenance should be performed with safety in mind.
Use extreme caution when working near the power conversion module (i.e., chopper). The large electrolytic capacitors store large amounts of energy even after power has been removed from the system. Wait at least five minutes after turning off power, and then use a voltmeter to verify that the capacitors are fully discharged before touching the power conversion module.
Capacitor failure can injure and/or cause property damage. If troubleshooting requires the system to be powered with the enclosure panels removed, remain clear of the capacitors. Failure of a capacitor can result in a sudden release of stored energy causing rupture of the capacitor case.

Note: A chopper troubleshooting flow chart can be found at the end of this section.

1. Turn off all power to the ProLine power supply.

2. Open the RHF console door and disconnect the black primary wires of the high frequency transformer from the 120 VAC line filter. Close the RHF console door to activate the door interlock switch.

3. Remove the front and left side panels from the power supply to expose the output terminal block and the microprocessor p.c. board.

4. Remove the Electrode and Nozzle leads from the **bottom** connections of the output terminal block (refer to Figure 3-3).

5. Apply three phase power to the unit and check the primary power on the input terminal block TB5 (refer to Figure 3-2).

6. Depress the ON button to energize the ProLine system, and then apply a start signal to the unit. **Note that the unit will only energize for approximately two seconds each time a start signal is applied. When making the following readings, be sure the red DC Power light is illuminated on the front control panel of the unit**. After applying the start signal, check the three phase voltage input to the chopper at the diode bridge terminals (three right side screws on the chopper assembly) for 208 VAC. If the voltage is not present, check for primary voltage on the main contactor CON and on the primary side of the power transformer.

7. With a start signal applied, check for 300 VDC at the ProLine output terminal block between Electrode and Work. If 300 VDC is present, the chopper is working properly.

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8. If 300 VDC is not present at the output terminal block, install a jumper wire between P28-7 & P28-8 (ILK1). With a start signal applied, check for 300 VDC at the Proline output terminal block between Electrode and Work. If 300 VDC is present, the chopper is working properly. Check the I/O PCB (HV- Output) and its wiring to the Microprocessor PCB.

9. If 300 VDC is not present at the output terminal block, check the chopper status LED's when a start signal is applied:
   a) LED's 1 through 5 off - go to step 10.
   b) LED's 1 through 5 on, LED 6 off - go to step 11.
   c) LED's 1 through 5 on, LED 6 on, LED 7 off - go to step 12.
   d) Only some of LED's 1 through 5 on - replace chopper.
   e) All LEDs on – replace chopper

10. Check the 120 VAC supply to the chopper between P1-1 and P1-3 on the chopper p.c. board. If 120 V is present, replace the chopper. If 120 V is not present, check fuse F3 and associated wiring.

11. Apply a start signal to the power supply and heck the DC voltage between P2-4 (ground) and P2-5 (signal) on the chopper p.c. board. This voltage should change from approximately 4.0 VDC to less than 1 VDC after the main contactor of the power supply is energized. If 4 VDC is not present, replace the chopper. If no voltage change occurs, check for approximately 4.0 VDC between P26-1 (ground) and P26-2 (signal) on the microprocessor p.c. board. If 4.0 VDC is not present, check continuity between P26 on the microprocessor p.c. board and P2 on the chopper p.c. board. If 4.0 VDC is present at the microprocessor p.c. board, replace the microprocessor.

12. **Turn off primary power to the power supply**. Disconnect P2 from the chopper p.c. board and P26 from the microprocessor p.c. board. Check continuity between P26-8 and P2-1 and between P26-7 and P2-2. Also check that these wires are not shorted to each other. If the cable is OK, connect P26 to the microprocessor p.c. board, but leave P2 disconnected from the chopper. With power applied, give the power supply a start signal and check for approximately 10 VDC between P26-7 (ground) and P26-8 (signal) when the main contactor is energized. If 10 VDC is not present, replace the microprocessor p.c. board. If 10 VDC is present, turn all power off, reconnect P2 to the chopper p.c. board, and repeat the test for 10 VDC between P2-2 (ground) and P2-1 (signal). If 10 VDC is present and LED 7 is not illuminated, replace the chopper.

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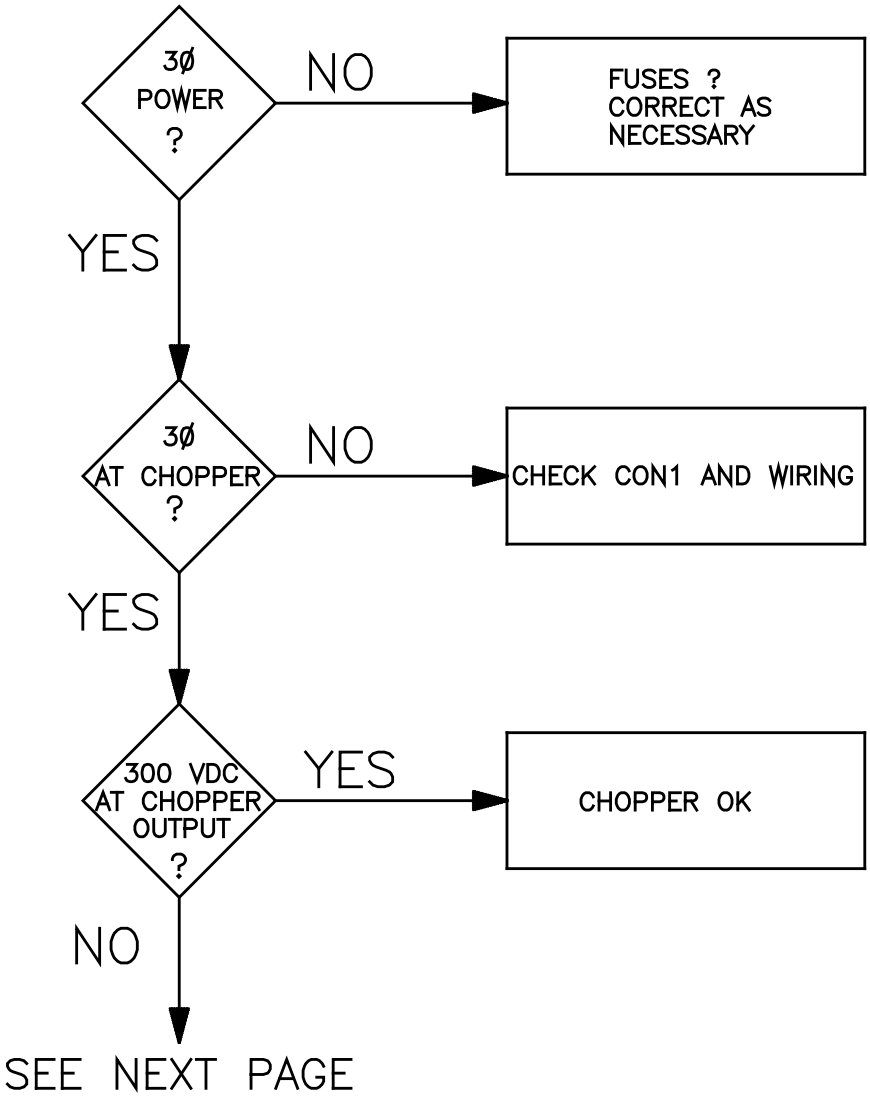

Figure 5-1 Chopper Diagnostics - Part 1

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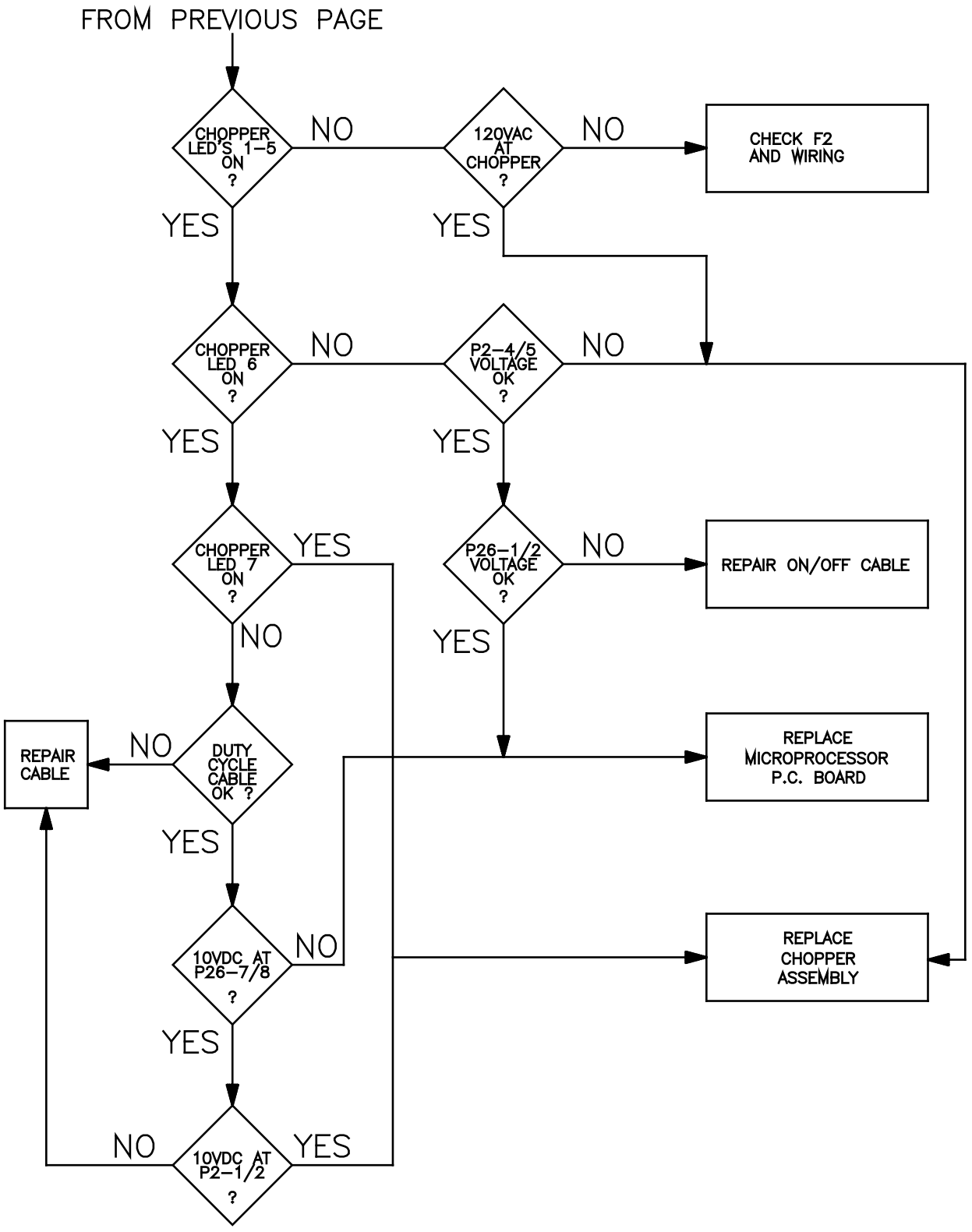

Figure 5-2 Chopper Diagnostics - Part 2

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Section 6 Parts List

Power Supply

Note: See Figures 6-1 to 6-4.

Item Number	Part Number	Quantity	Description
1	708088	1	Off switch, red
2	708111	1	Off actuator, red
3	708090	1	On switch, green
4	708089	1	On actuator, green / illuminated
5	501163	2	Light housing
6	501164	2	Bulb
7	501162	1	White lens
8	501161	1	Red lens
12	707150	1	L1 inductor
13	500557	1	TR2 control transformer, 208/230/460 V / 60 Hz
	706205		TR2 control transformer, 575 V / 60 Hz
	500559		TR2 control transformer, 380/415 V / 50/60 Hz
14	706151	1	TR1 main transformer, 208 V / 60 Hz / 3Ø
	706150		TR1 main transformer, 230/460 V / 60 Hz / 3Ø
	706152		TR1 main transformer, 380 V / 50/60 Hz / 3Ø
	706153		TR1 main transformer, 415 V / 50/60 Hz / 3Ø
	706154		TR1 main transformer, 575 V / 60 Hz / 3Ø
15	709086	4	TB1 – TB4 terminal block marker strip, 14 position
16	709007	4	TB1 – TB4 terminal block, 14 position
17	709058	9	F2-F5, F7-F11 fuse holder
18	709012	1	F10 fuse, AGC 3A fuse
19	709011	2	F3/F4 fuse, AGC 5A
20	709059	1	F8 fuse, AGC 2A
21	709076	3	F7/F9/F11 fuse, AGC 1/2A
22	709033	1	F5 fuse, AGC 1A
23	216450	1	Microprocessor p.c. board assembly
24	709002	3	P8/P12/P13, 14 socket receptacle
25	709001	1	P7, 4 pin receptacle
26	709124	1	P16, 9 socket receptacle
27	709061	2	F1A/F1B fuse holder
28	709128	2	F1A/F1B fuse, FNM 6.25A
29	709060	1	Strain relief
30	500810	1	A.C. detect p.c. board assembly
31	200092	1	Coolant reservoir, without fittings or cap
Not shown	200292	1	Coolant reservoir assembly, with fittings and cap
32	500518	1	Coolant reservoir cap/level gauge
33	708062	1	LS1 coolant level switch
34	505024	1	TS1 Coolant temperature switch
35	500052	1	Pump motor, 1/3hp-230V-50/60 Hz

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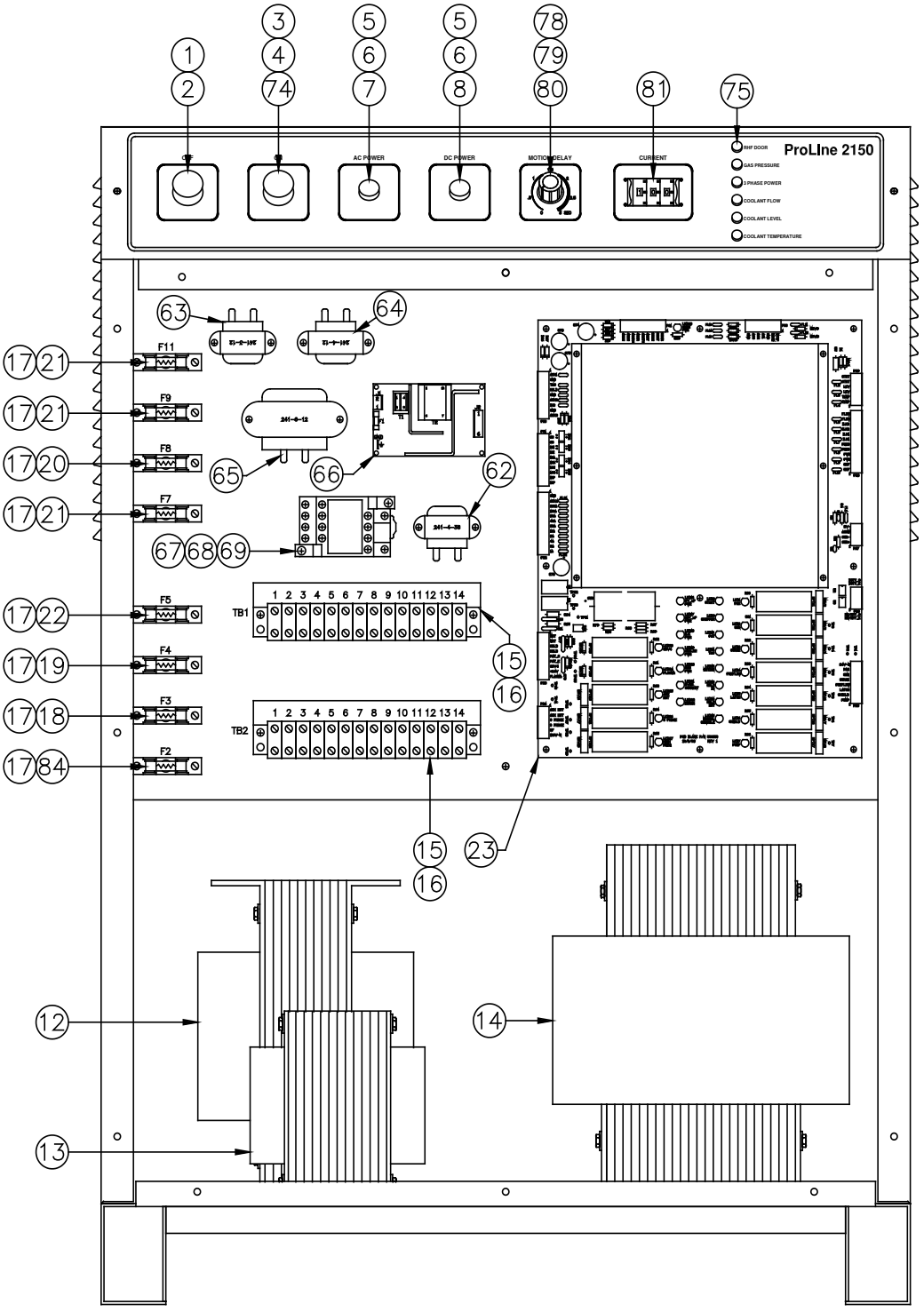
Item Number	Part Number	Quantity	Description
36	500513	1	V-band clamp
37	500511	1	Coolant pump, 70 gph
38	708061	1	Solenoid valve, 220/240VAC
39	715084	1	Check valve, coolant return
40	708068	1	CON3 coolant pump relay
41	708059	1	FS1 coolant flow switch
42	500516	2	Fan, heat exchanger / front panel
43	500514	1	Heat exchanger
44	150900	1	Shunt
45	500509	1	Coolant filter housing
46	500510	1	Coolant filter/deionization cartridge
47	708110	1	CON main contactor
48	500348	1	Relay p.c. board assembly
49	702048	1	EMI filter, 380/415 V units only
50	708118	2	CR2/PAR relay
51	701165	2	R7/R8, 3 ohm pilot arc resistor
52	500536	1	PAT IGBT drive p.c. board assembly
53	705011	1	PAT IGBT
54	709167	1	TB5 3Ø power terminal block
55	702075	2	PAT IGBT filter capacitor
56	277452	1	I/O p.c. board assembly
57	Contact factory	1	Height control voltage divider p.c. board assembly
58	150004	1	Chopper assembly
59	709117	1	I/O terminal block (small)
	709228	1	I/O terminal block (large)
62	706036	1	TR8 transformer, 241-4-36
63	706041	1	TR7 transformer, 241-3-12
64	706042	1	TR5 transformer, 241-4-12
65	706043	1	TR3 transformer, 241-6-12
66	280003	1	Power supply, 24VDC
67	708103	1	CR1 relay
68	708104	1	CR1 relay socket
69	708105	1	CR1 hold-down clip
72	709190	1	TB6 terminal block marker strip, 4 position
73	709191	1	TB6 terminal block, 4 position
74	740106	1	Bulb, power on switch
75	704050	6	LED/lens, green
76	200204	3	Fan, 120V
77	715052	1	Drain petcock
78	701051	1	Motion delay potentiometer
79	710190	1	Motion delay knob
80	710191	1	Motion delay knob lock
81	277070	1	Current thumbwheel assembly
82	500526	2	Fan Guard
83	709227	2	Strain relief
84	709231	1	F2 fuse, MDL 5A
86	701141	1	R9, 2 ohm pilot arc resistor

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.



Front panel fan not shown (item number 42)

Figure 6-1 Power Supply Front View

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

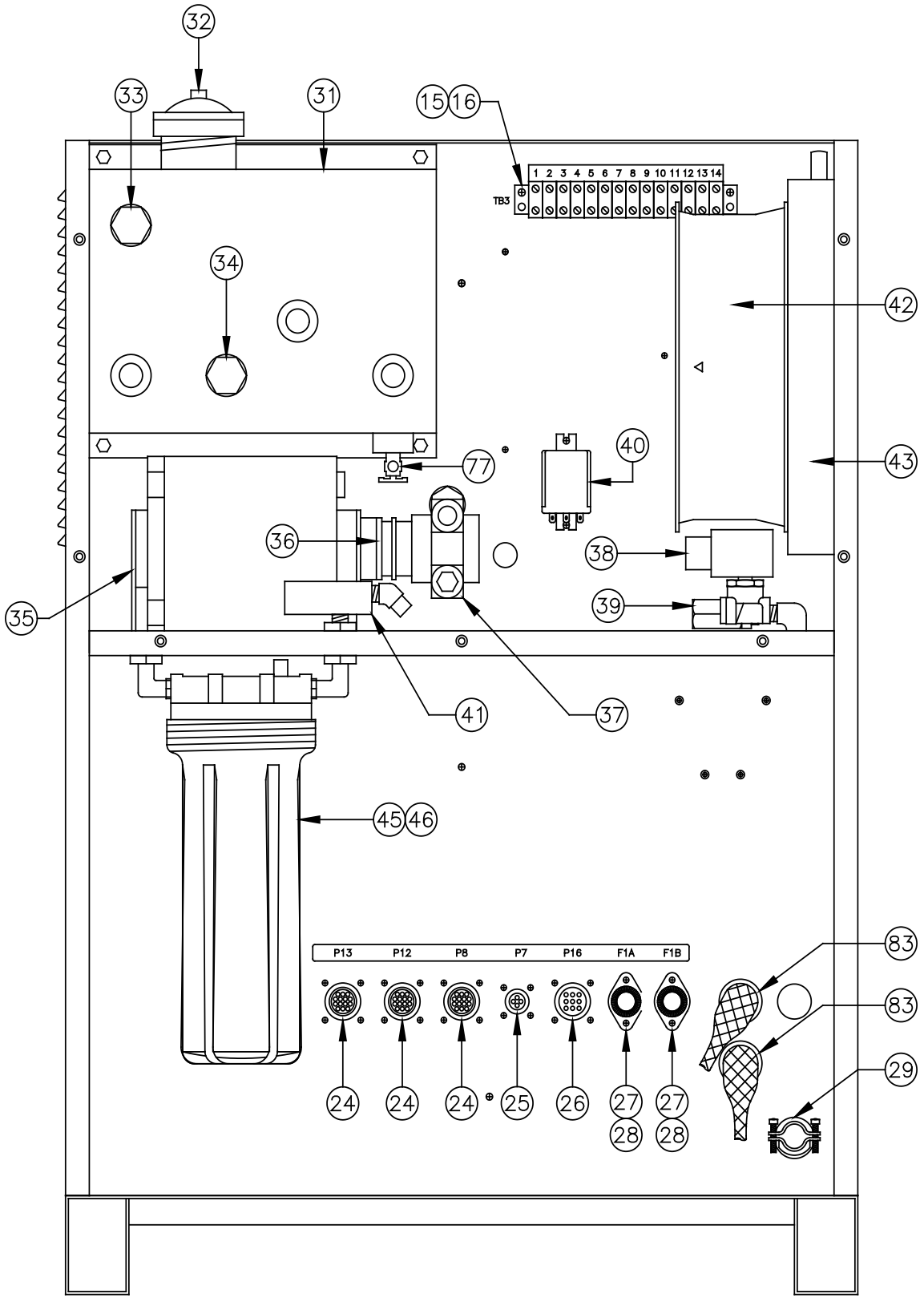


Figure 6-2 Power Supply Rear View

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

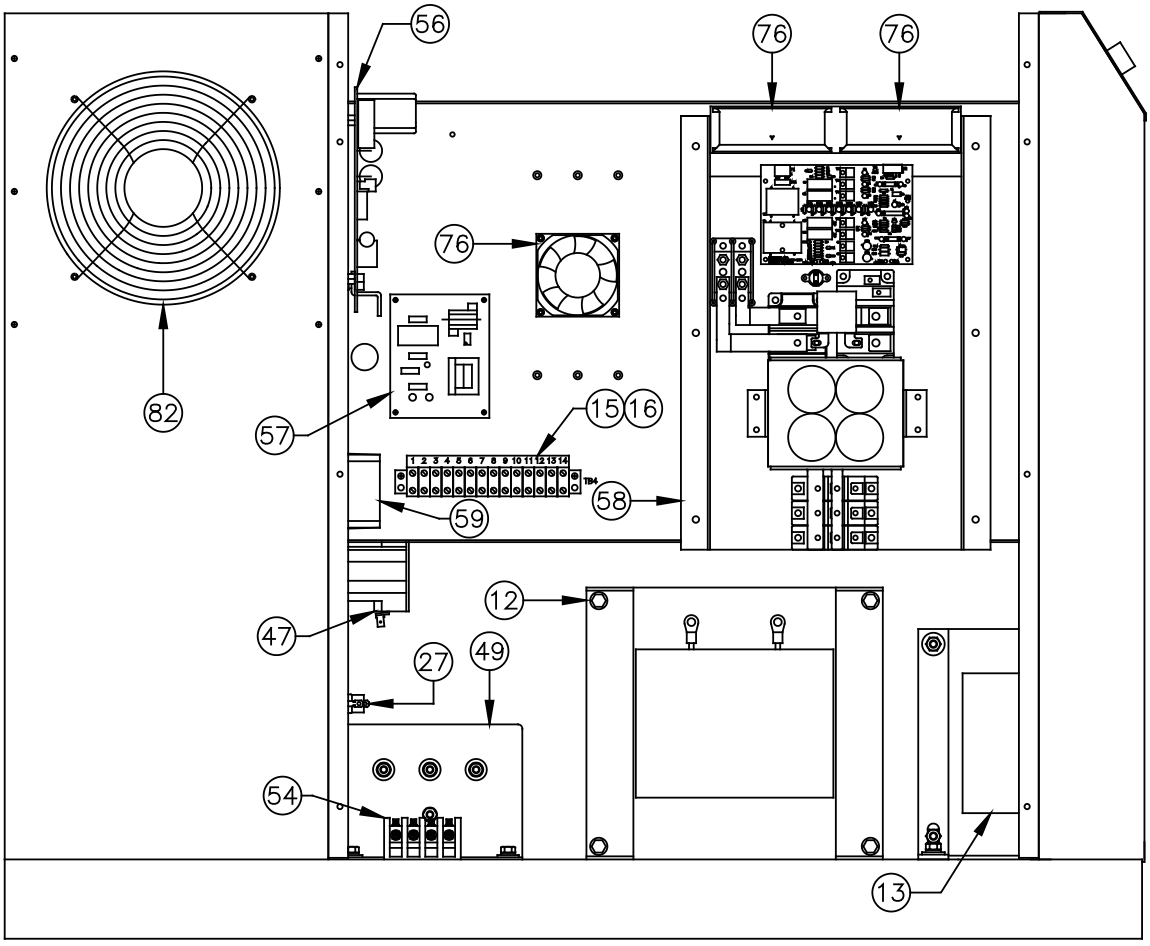


Figure 6-3 Power Supply Left Side View

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

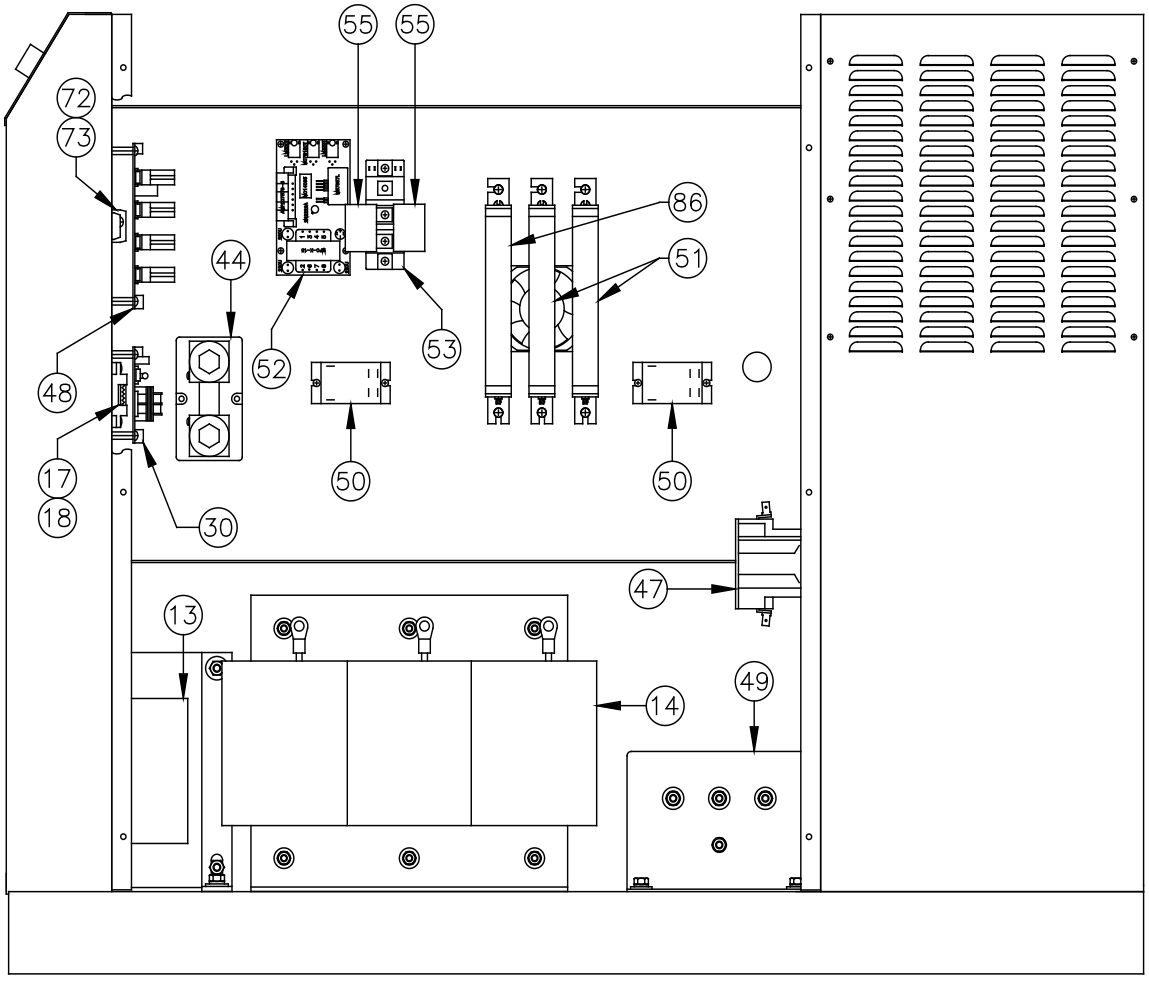


Figure 6-4 Power Supply Right Side View

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Remote High Frequency Console

Note: See Figure 6-5.

Item Number	Part Number	Quantity	Description
1	715051	2	Coolant return fitting (left hand)
2	715050	1	Coolant supply fitting (right hand)
3	709227	1	Strain relief
5	709001	1	4 pin receptacle
6	707001	1	Line filter
7	706109	1	Transformer – 5000V, 20 mA
8	702069	1	Capacitor – 15 kV
9	708057	1	Door interlock switch
10	500014	1	Spark gap assembly
11	740039	3	Spark gap electrode
12	505043	1	High frequency inductor
13	740072	1	Standoff
14	800041	1	Busbar
15	500505	1	RHF console p.c. board assembly
16	715021	1	Coolant supply fitting (right hand)
17	500503	1	Cathode manifold
18	205010	1	CTP sensor lead filter assembly
19	200287	1	Transformer insulating plate
22	500098	1	Ground cable

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

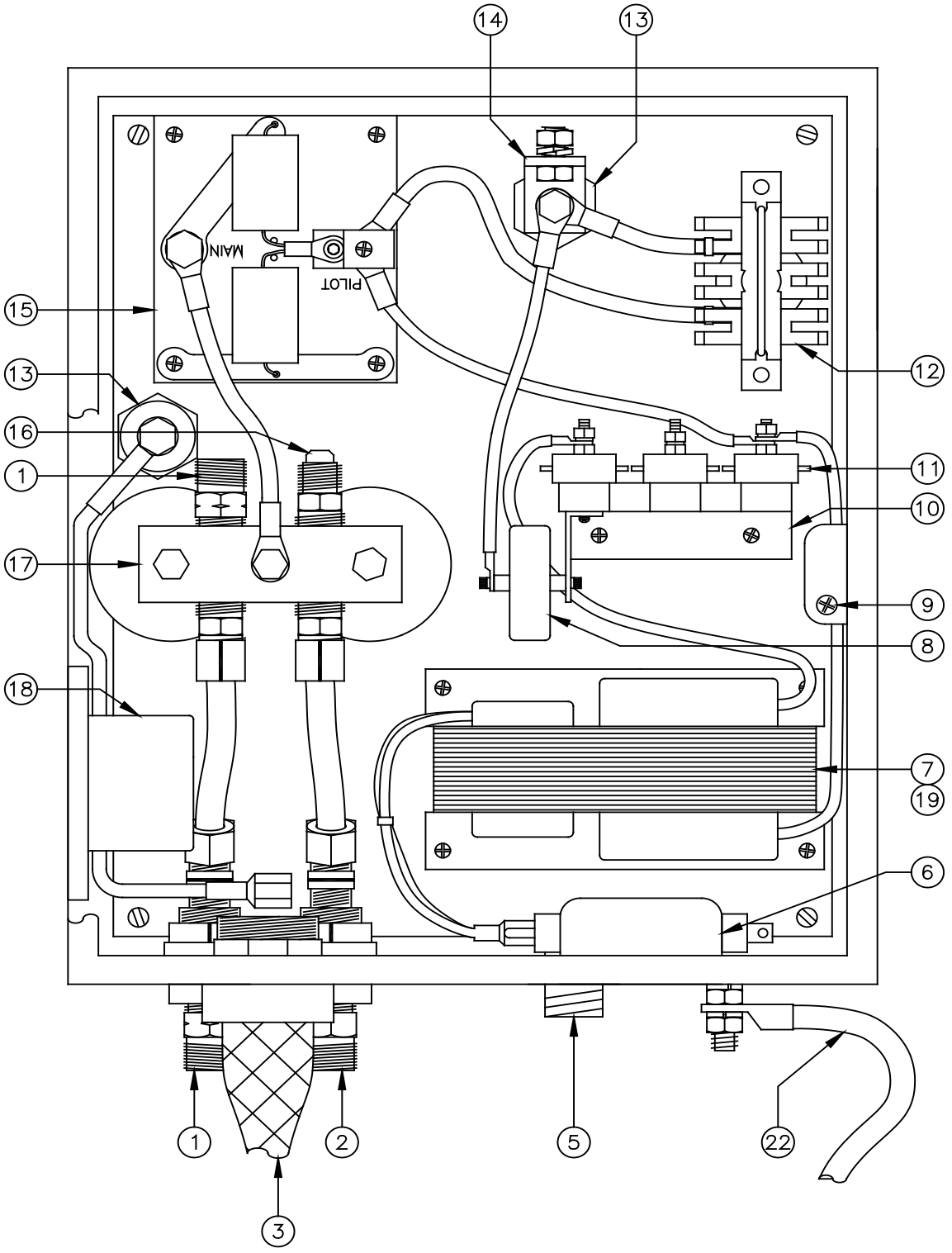


Figure 6-5 Remote High Frequency Console

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Torch and Torch Valve Assembly

Item Number	Part Number	Quantity	Description
1	277475	1	Torch valve assembly (includes bracket)
2	500549	1	Torch valve bracket
3	820134	1	Torch Handle
4	279050	1	Torch Base
5	279150	1	Torch Head (Copper Electrode)
6	820209	1	O-ring (red)
7	500024	1	O-ring (blue)
8	500018	1	O-ring (red)
9	279013	1	O-ring (red) - indicator only, not a seal
10	279112	1	O-ring (red)
11	279113	6	O-ring (red)
12	500740	1	Torch solenoid plasma hose
Not shown	716012	1	O-ring lubricant
Not shown	277056	1	Nozzle removal tool
Not shown	277086	1	Electrode removal tool driver
Not shown	277087	1	Copper Electrode removal tool

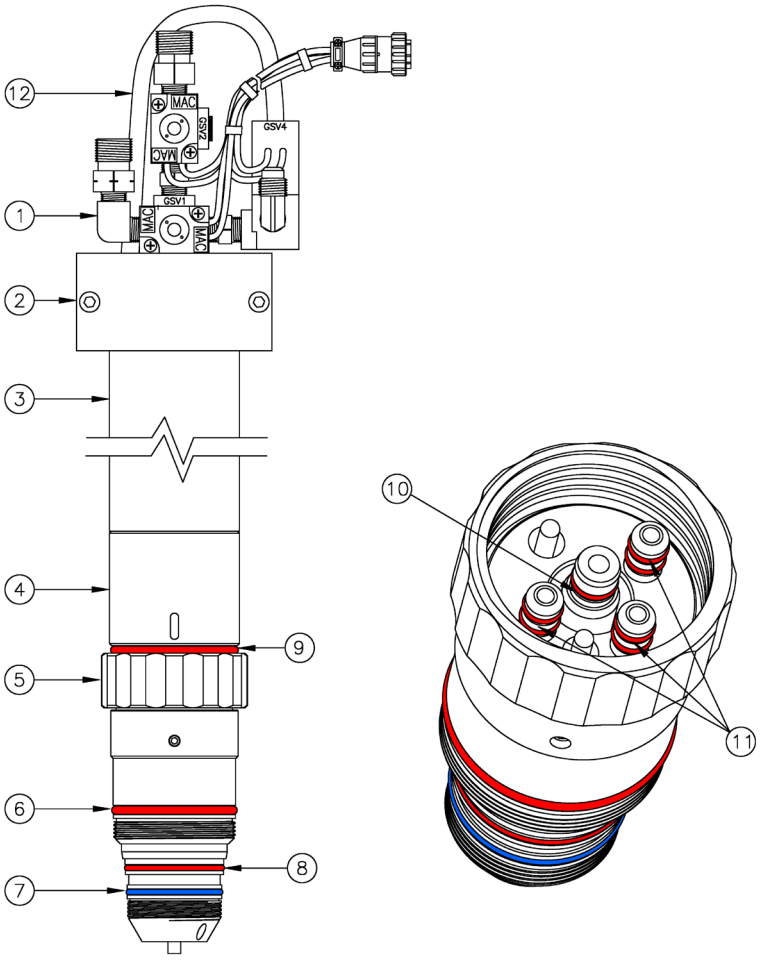


Figure 6-6 Torch and Torch Valve Assembly

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Shielded Torch Leads

Part Number	Length
277304-10	10 ft. (3.0 m)
277304-15	15 ft. (4.6 m)
277304-20	20 ft. (6.1 m)
277304-25	25 ft. (7.6 m)
277304-30	30 ft. (9.1 m)
277304-35	35 ft. (10.7 m)
277304-40	40 ft. (12.2 m)
277304-45	45 ft. (13.7 m)
277304-50	50 ft. (15.2 m)

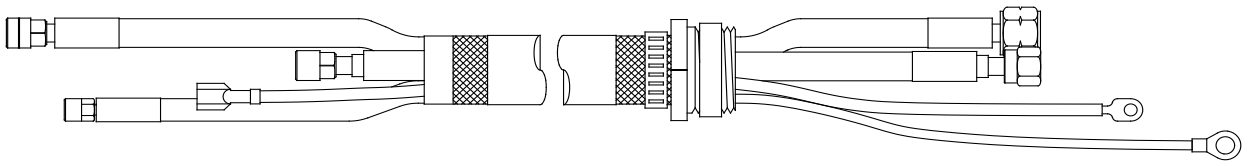


Figure 6-7 Shielded Torch Leads

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Gas Hose Package

Part Number	Length
277317-20	20 ft. (6.1 m)
277317-25	25 ft. (7.6 m)
277317-30	30 ft. (9.1 m)
277317-35	35 ft. (10.7 m)
277317-40	40 ft. (12.2 m)
277317-45	45 ft. (13.7 m)
277317-50	50 ft. (15.2 m)
277317-55	55 ft. (16.8 m)
277317-60	60 ft. (18.3 m)
277317-65	65 ft. (19.8 m)
277317-70	70 ft. (21.3 m)
277317-75	75 ft. (22.9 m)
277317-80	80 ft. (24.4 m)
277317-85	85 ft. (25.9 m)
277317-90	90 ft. (27.4 m)
277317-95	95 ft. (29.0 m)
277317-100	100 ft. (30.5 m)

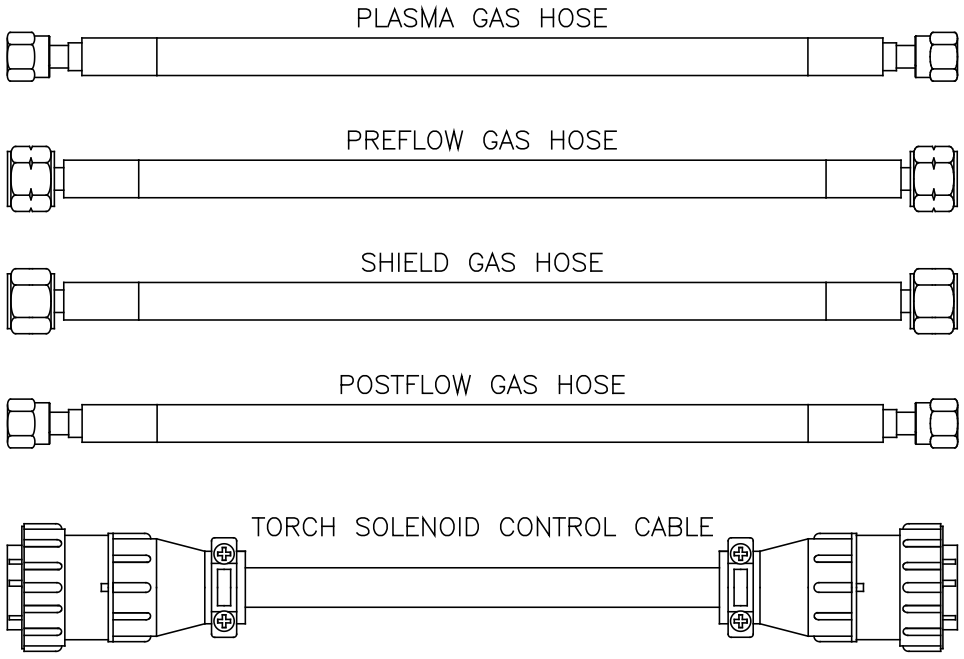


Figure 6-8 Gas Hose Package

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Coolant and Power Leads

Part Number	Length
277306-5	5 ft. (1.5 m)
277306-10	10 ft. (3.0 m)
277306-15	15 ft. (4.6 m)
277306-20	20 ft. (6.1 m)
277306-25	25 ft. (7.6 m)
277306-30	30 ft. (9.1 m)
277306-35	35 ft. (10.7 m)
277306-40	40 ft. (12.2 m)
277306-45	45 ft. (13.7 m)
277306-50	50 ft. (15.2 m)
277306-55	55 ft. (16.8 m)
277306-60	60 ft. (18.3 m)
277306-65	65 ft. (19.8 m)
277306-70	70 ft. (21.3 m)
277306-75	75 ft. (22.9 m)
277306-80	80 ft. (24.4 m)
277306-85	85 ft. (25.9 m)
277306-90	90 ft. (27.4 m)
277306-95	95 ft. (29.0 m)
277306-100	100 ft. (30.5 m)

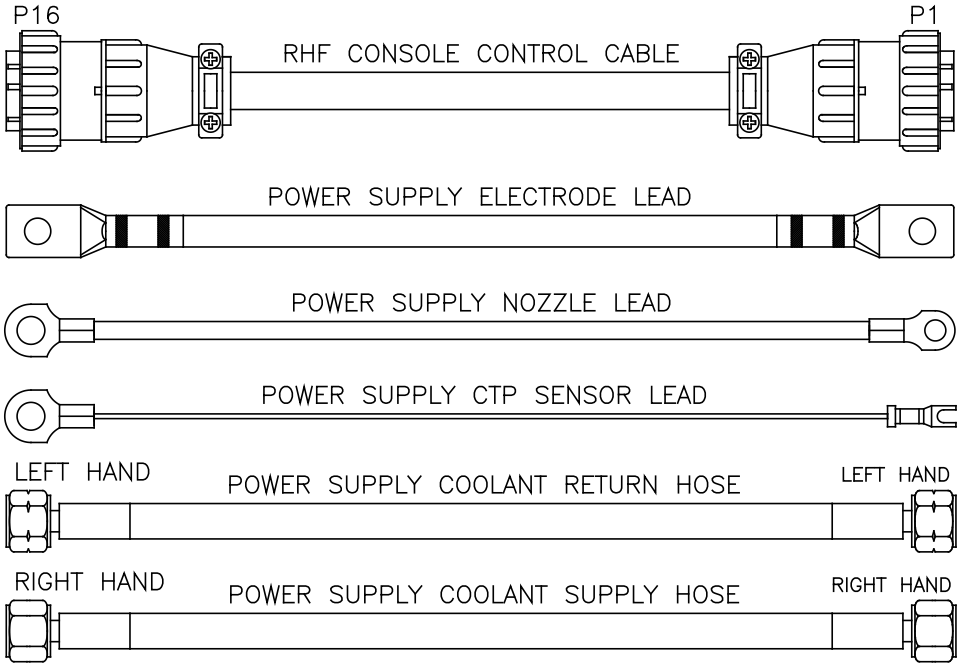


Figure 6-9 Coolant and Power Leads

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Work Ground Cable

Part Number	Length
277318-10	10 ft. (3.0 m)
277318-15	15 ft. (4.6 m)
277318-20	20 ft. (6.1 m)
277318-25	25 ft. (7.6 m)
277318-30	30 ft. (9.1 m)
277318-35	35 ft. (10.7 m)
277318-40	40 ft. (12.2 m)
277318-45	45 ft. (13.7 m)
277318-50	50 ft. (15.2 m)
277318-55	55 ft. (16.8 m)
277318-60	60 ft. (18.3 m)
277318-65	65 ft. (19.8 m)
277318-70	70 ft. (21.3 m)
277318-75	75 ft. (22.9 m)
277318-80	80 ft. (24.4 m)
277318-85	85 ft. (25.9 m)
277318-90	90 ft. (27.4 m)
277318-95	95 ft. (29.0 m)
277318-100	100 ft. (30.5 m)

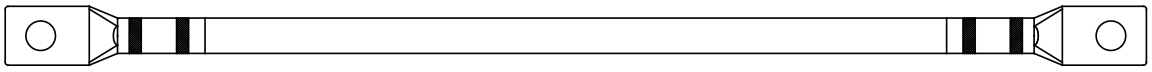


Figure 6-10 Work Ground Cable

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Torch Consumables - Mild Steel Cutting
Copper Electrode

	Outer Retaining Cap	Shield Cap	Inner Retaining Cap	Nozzle	Swirl Ring	Copper Electrode	Torch Head
30A	277154	277145	277153	277120	277140	277130	279150
50A	277154	277115	277153	277122	277140/ 277142	277131	279150
70A	277154	277150	277153	277125	277142	277131	279150
100A	277154	277286	277151	277284	277283	277282	279150
150A	277154	277117	277151/ 277152	277293	277139	277292	279150

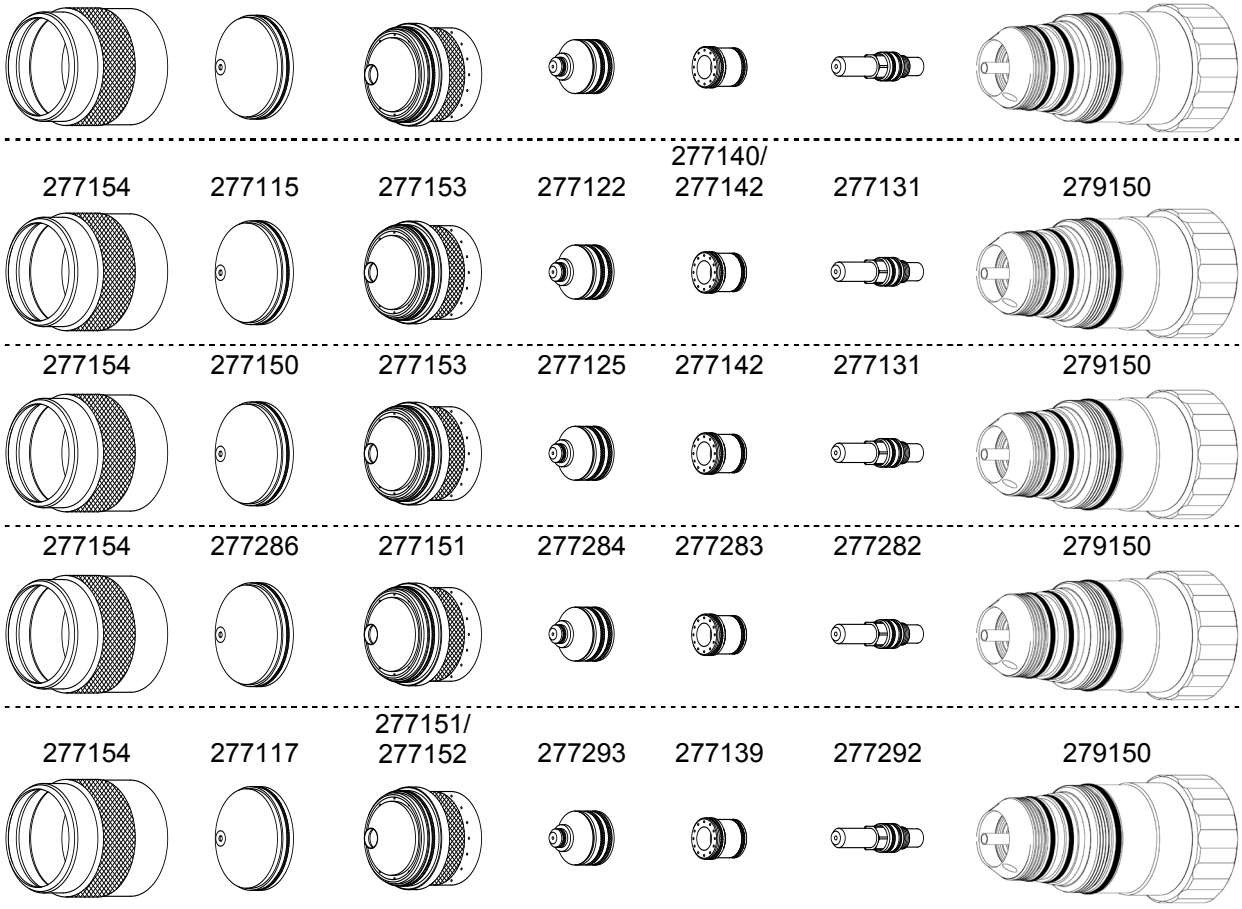
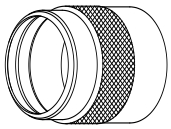
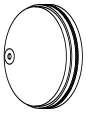
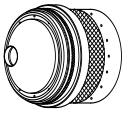
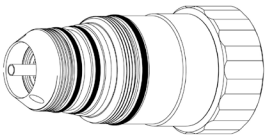
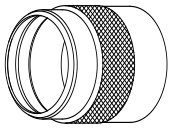
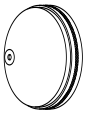
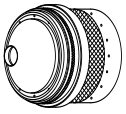
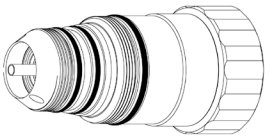


Figure 6-11 Torch Consumables - Mild Steel Cutting, Copper Electrode

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Torch Consumables - Stainless Steel Cutting (Air Plasma) Copper Electrode

	Outer Retaining Cap	Shield Cap	Inner Retaining Cap	Nozzle	Swirl Ring	Copper Electrode	Torch Head
	277154	277144	277110	277121	277138	277137	279150
30A							
	277154	277149	277110	277123	277142	277137	279150
50A							
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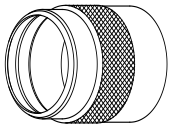
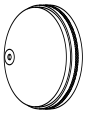
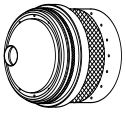
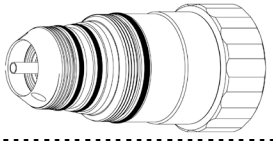
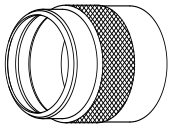
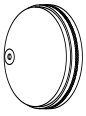
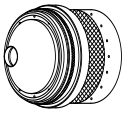
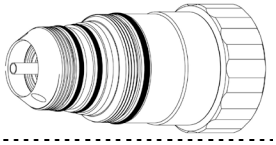
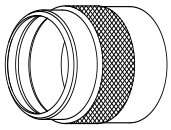
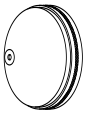
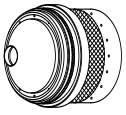
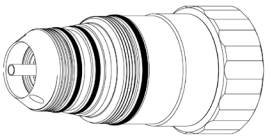
70A							
	277154	277286	277151	277284	277283	277282	279150
100A							
	277154	277117	277152	277293	277139	277292	279150
150A							

Figure 6-12 Torch Consumables - Stainless Steel Cutting (Air), Copper Electrode

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Torch Consumables - Stainless Steel Cutting (H17 Plasma) Copper Electrode

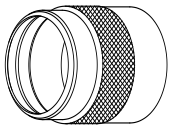
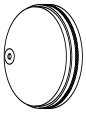
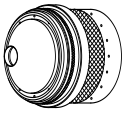
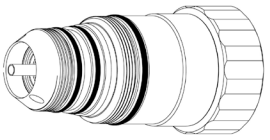
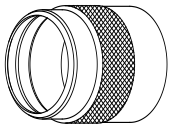
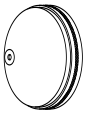
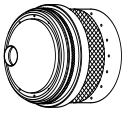
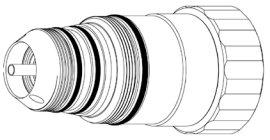
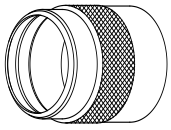
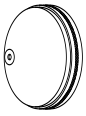
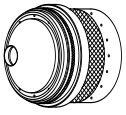
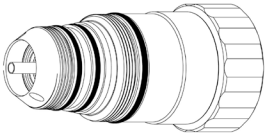
	Outer Retaining Cap	Shield Cap	Inner Retaining Cap	Nozzle	Swirl Ring	Copper Electrode	Torch Head
	277154	277150	277113	277124	277140	277132	279150
70A							
	277154	277146	277113	277126	277141	277133	279150
100A							
	277154	277298	277266	277297	277139	277135	279150
150A							

Figure 6-13 Torch Consumables - Stainless Steel Cutting (H17), Copper Electrode

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Torch Consumables - Aluminum Cutting
Copper Electrode

	Outer Retaining Cap	Shield Cap	Inner Retaining Cap	Nozzle	Swirl Ring	Copper Electrode	Torch Head
30A	277154	277145	277153	277120	277140	277130	279150
50A	277154	277150	277153	277122	277142	277131	279150
70A	277154	277150	277153	277125	277142	277131	279150
100A	277154	277286	277151	277284	277283	277282	279150
150A	277154	277117	277152	277293	277139	277292	279150

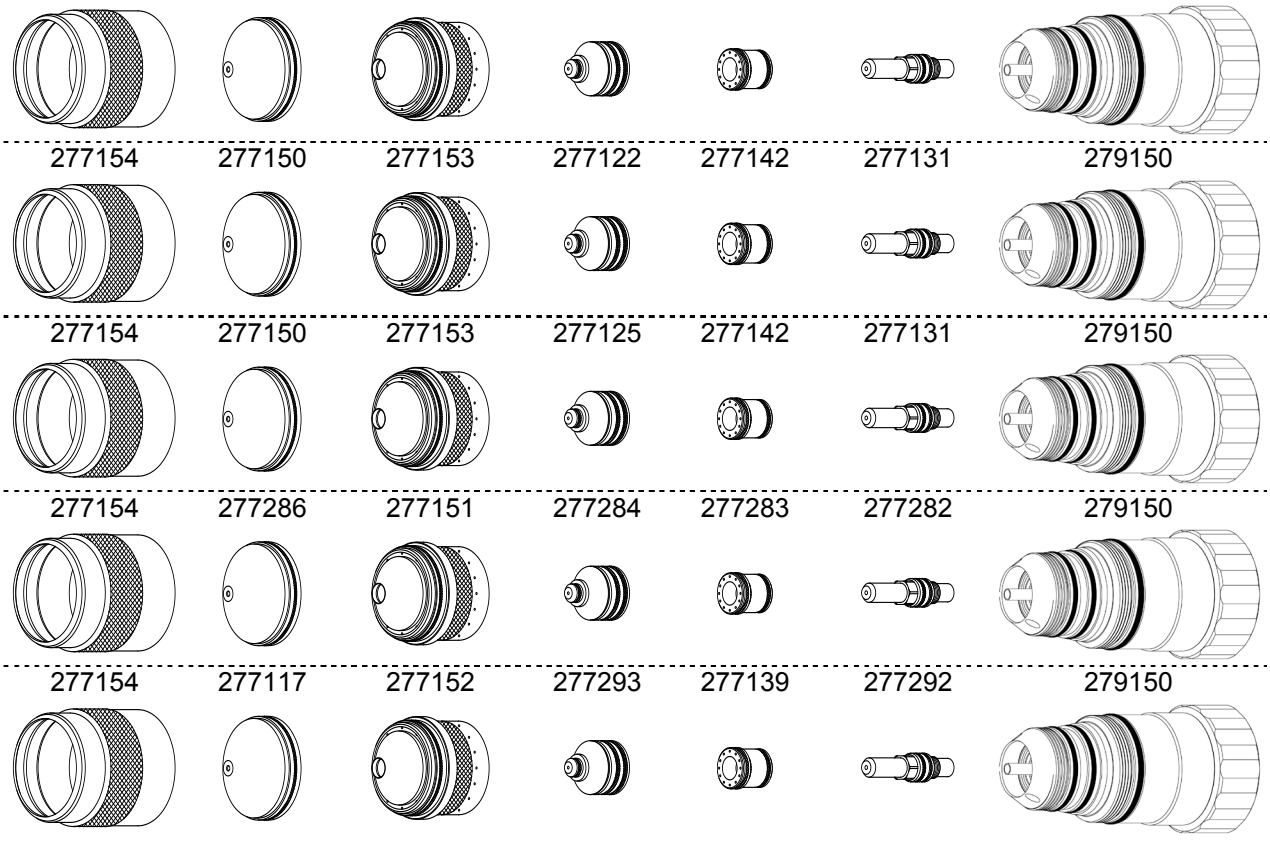


Figure 6-14 Torch Consumables - Aluminum Cutting, Copper Electrode

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Torch Consumables – Marking
Copper Electrode

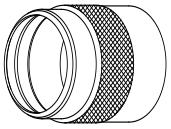
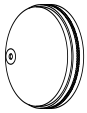
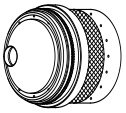
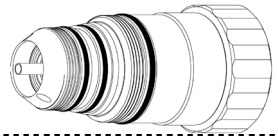
Outer Retaining Cap	Shield Cap	Inner Retaining Cap	Nozzle	Swirl Ring	Copper Electrode	Torch Head
277154	277145	277152	277120	277140	277190	279150
						

Figure 6-15 Torch Consumables, Copper Electrode

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Gas Console Without Integrated Inova (Assembly 277080)

Note: See Figures 6-16 and 6-17.

Item Number	Part Number	Quantity	Description
1	708076	4	Pressure gauge – 200 psi
2	708075	1	Pressure gauge – 100 psi
3	708113	2	Pressure gauge – 160 psi
4	708114	1	Pressure gauge – 15 psi
5	500562	1	Pressure regulator – 60 psi
6	500570	2	Pressure regulator – 125 psi
7	500061	1	Pressure regulator – 15 psi
8	708115	1	Gas test/run switch
9	708116	1	Gas test/run switch knob
10	500568	1	Fan
11	501147	1	Fan guard/filter
12	709002	1	Receptacle, 14 position
13	709003	2	Receptacle, 9 position
14	709001	2	Receptacle, 4 position
15	709229	1	Fuse, 1.5 amp
16	709010	1	Fuse Holder
17	709179	1	Terminal block, 10 position
18	709192	1	Terminal block marker strip, 10 position
19	277060	1	Gas console relay p.c. board
20	706053	1	Transformer, 24VAC
21	707001	1	Line filter
22	709004	1	Receptacle, 24 position
23	501145	7	Manifold
24	708097	2	Pressure switch, 80-200 psi
25	708077	1	Solenoid valve
42	708030	1	Pressure switch, 10 psi
43	708046	1	Pressure switch, 20-50 psi

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Gas Console With Integrated Inova (Imperial Assembly 277085 / Metric Assembly 277090)

Note: See Figures 6-16 and 6-17.

Item Number	Part Number	Quantity	Description
1	708076	4	Pressure gauge – 200 psi
2	708075	1	Pressure gauge – 100 psi
3	708113	2	Pressure gauge – 160 psi
4	708114	1	Pressure gauge – 15 psi
5	500562	1	Pressure regulator – 60 psi
6	500570	2	Pressure regulator – 125 psi
7	500061	1	Pressure regulator – 15 psi
8	708115	1	Gas test/run switch
9	708116	1	Gas test/run switch knob
10	500568	1	Fan
11	501147	1	Fan guard/filter
12	709002	3	Receptacle, 14 position
13	709003	5	Receptacle, 9 position
14	709001	2	Receptacle, 4 position
15	709229	1	Fuse, 1.5 amp
16	709010	3	Fuse Holder
17	709179	1	Terminal block, 10 position
18	709192	1	Terminal block marker strip, 10 position
19	277060	1	Gas console relay p.c. board
20	706053	1	Transformer, 24VAC
21	707001	1	Line filter
22	709004	4	Receptacle, 24 position
23	501145	7	Manifold
24	708097	2	Pressure switch, 80-200 psi
25	708077	1	Solenoid valve
30	706003	1	Transformer, 20VAC
31	709191	1	Terminal block, 4 position
32	709190	1	Terminal block marker strip, 4 position
33	110900	1	Inova H-Bridge p.c. board, 230VAC
34	110200	1	Inova microprocessor p.c. board
35	110705	1	Inova power distribution p.c. board, 230VAC
36	709207	1	Receptacle, 7 position
37	709084	1	Ground lug
38	709012	1	Fuse, 3 amp
39	709210	1	Fuse, 6 amp
40	277081	9	Inova insulating washer (top)
41	277082	9	Inova insulating bushing (bottom)
42	708030	1	Pressure switch, 10 psi
43	708046	1	Pressure switch, 20-50 psi

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

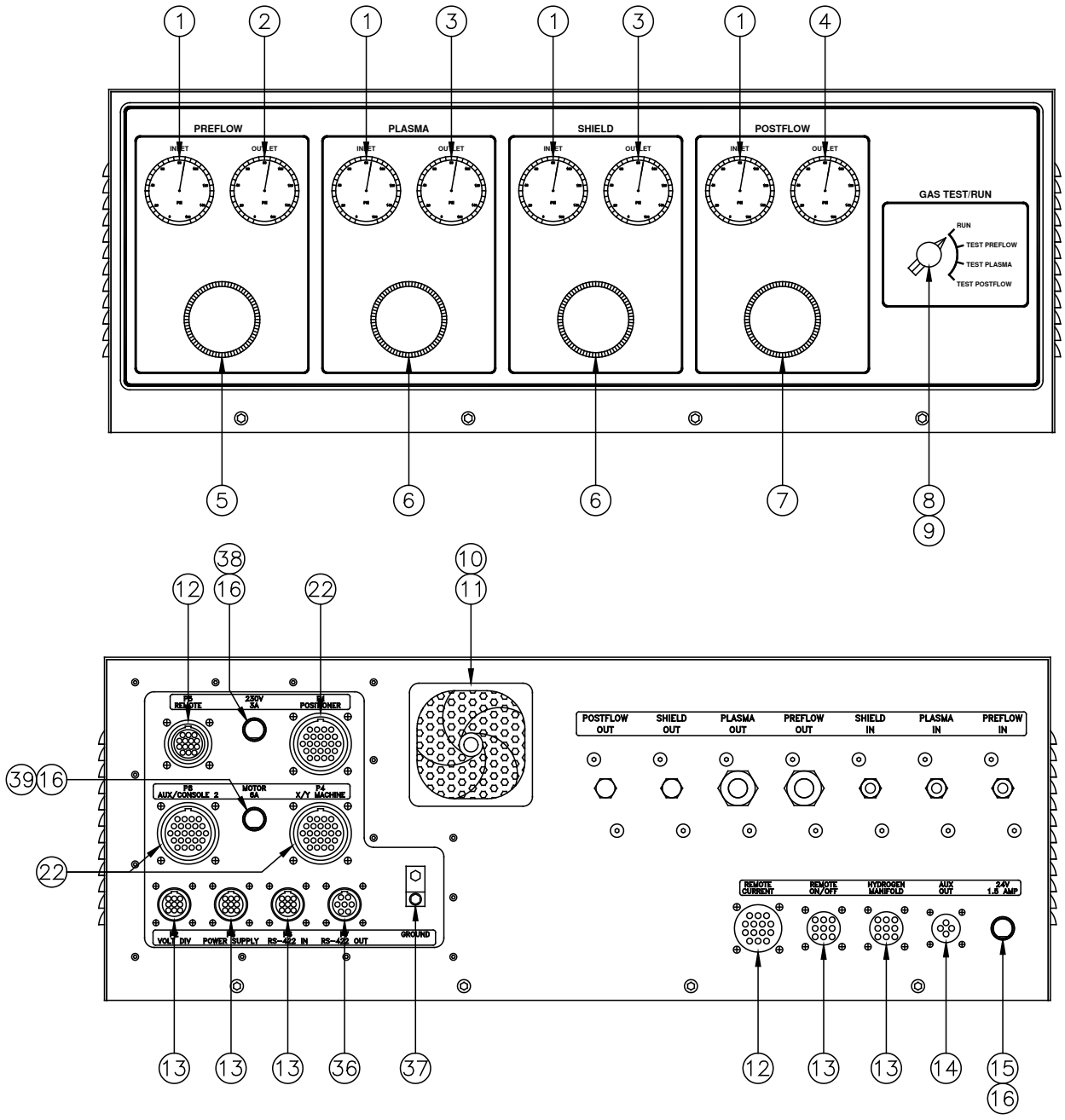


Figure 6-16 Gas Console - Exterior

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

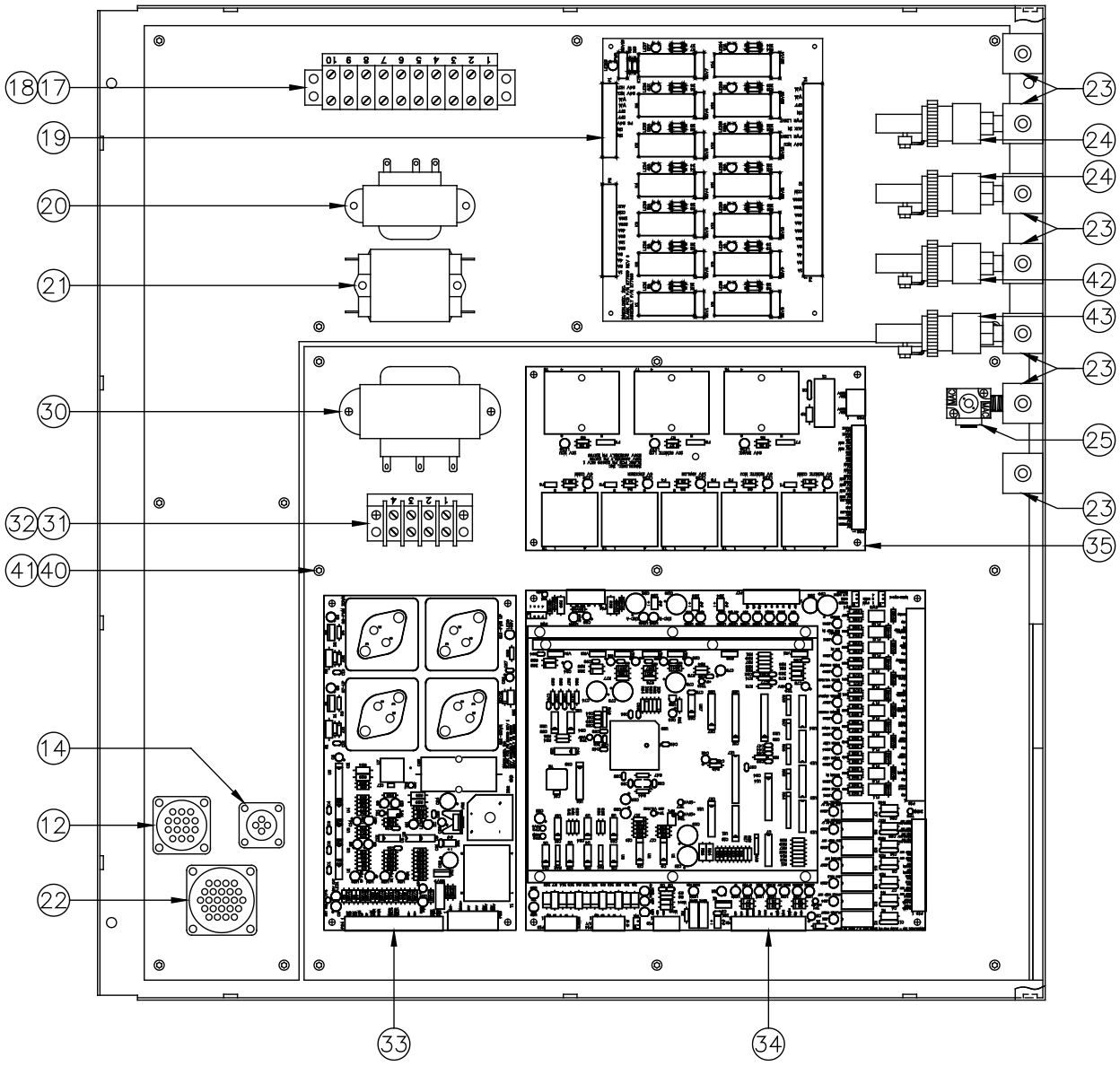


Figure 6-17 Gas Console – Interior

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Power Supply Microprocessor P.C. Board (Assembly 216450)

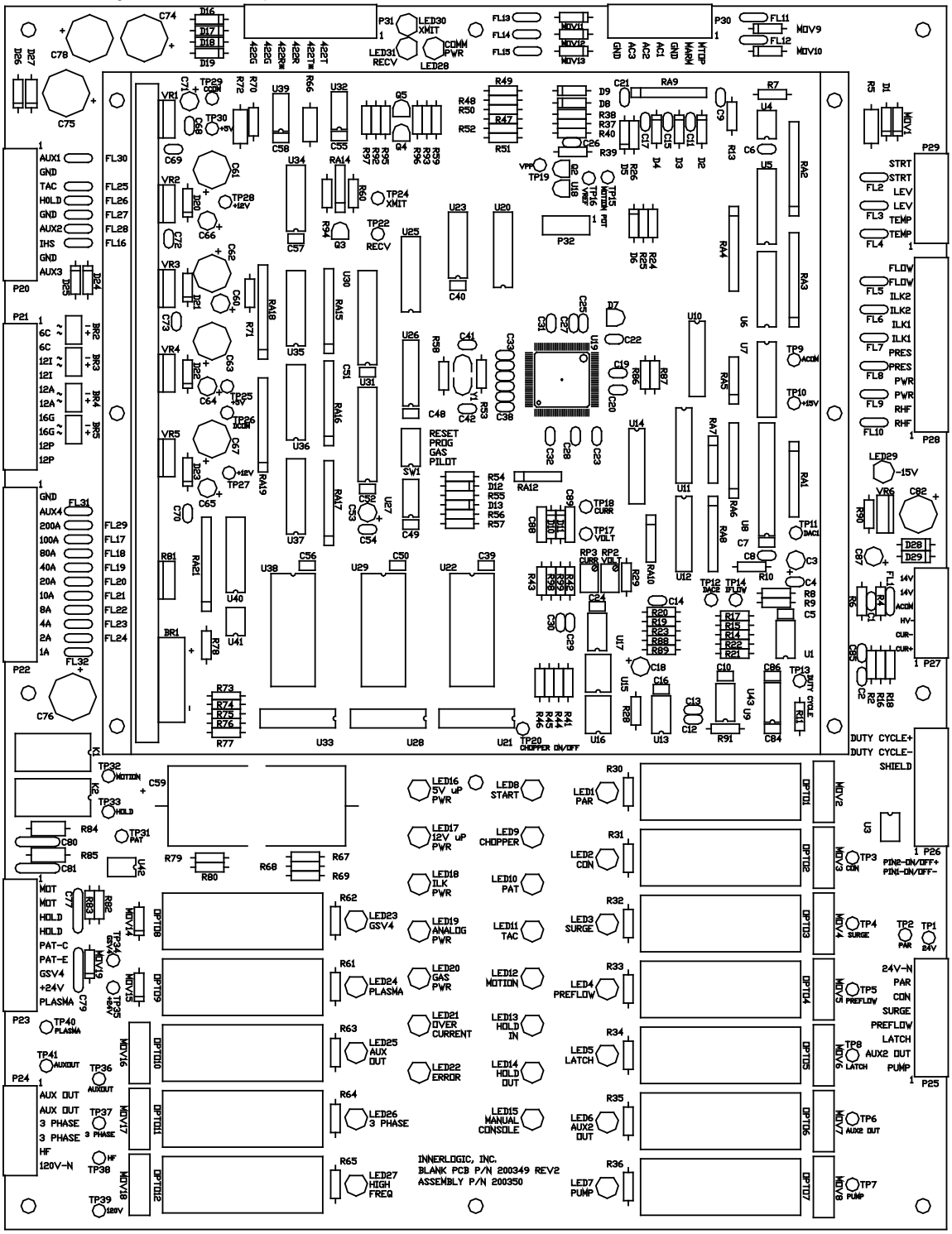


Figure 6-18 Power Supply Microprocessor P.C. Board

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

A.C. Detect P.C. Board (Assembly 500810)

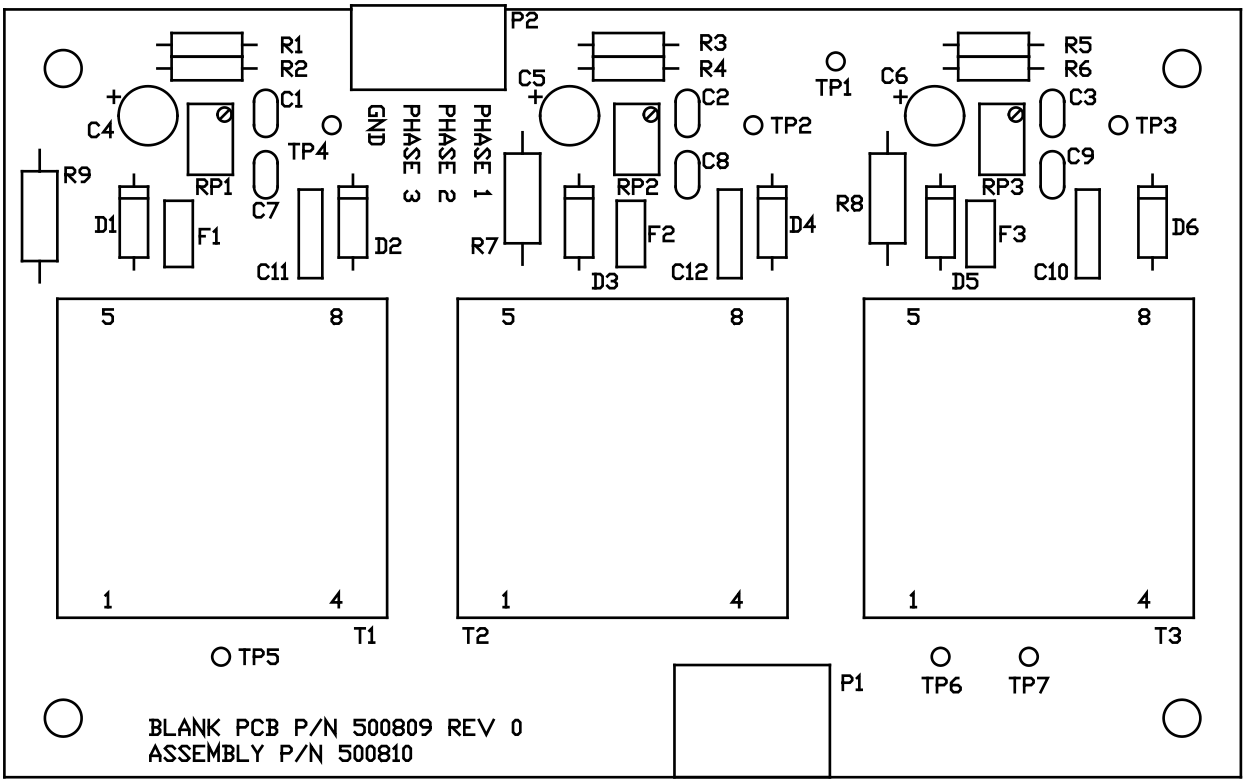


Figure 6-19 A.C. Detect P.C. Board

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Power Supply Relay P.C. Board (Assembly 500348)

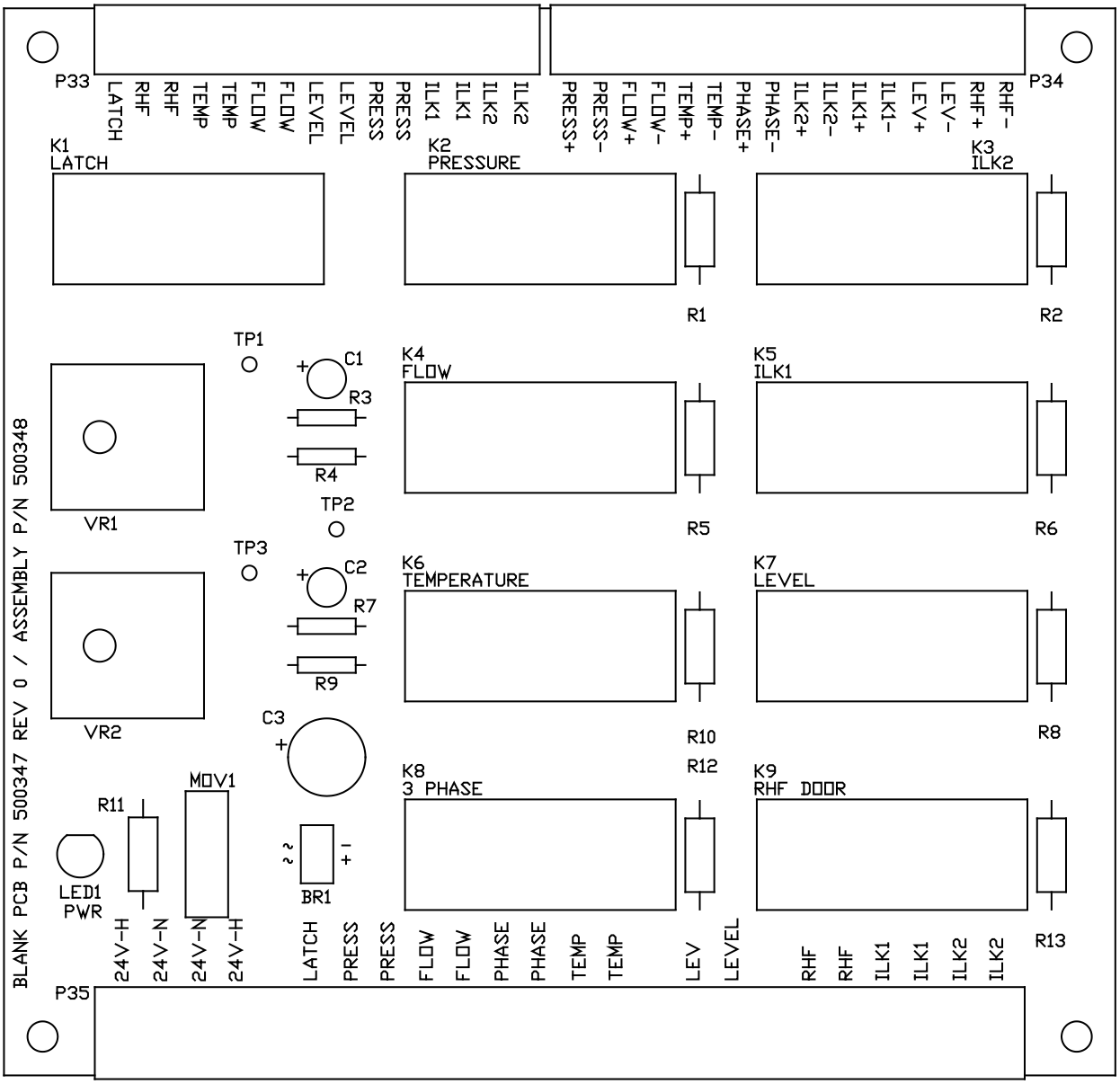


Figure 6-20 Power Supply Relay P.C. Board

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Power Supply I/O P.C. Board (Assembly 277452)

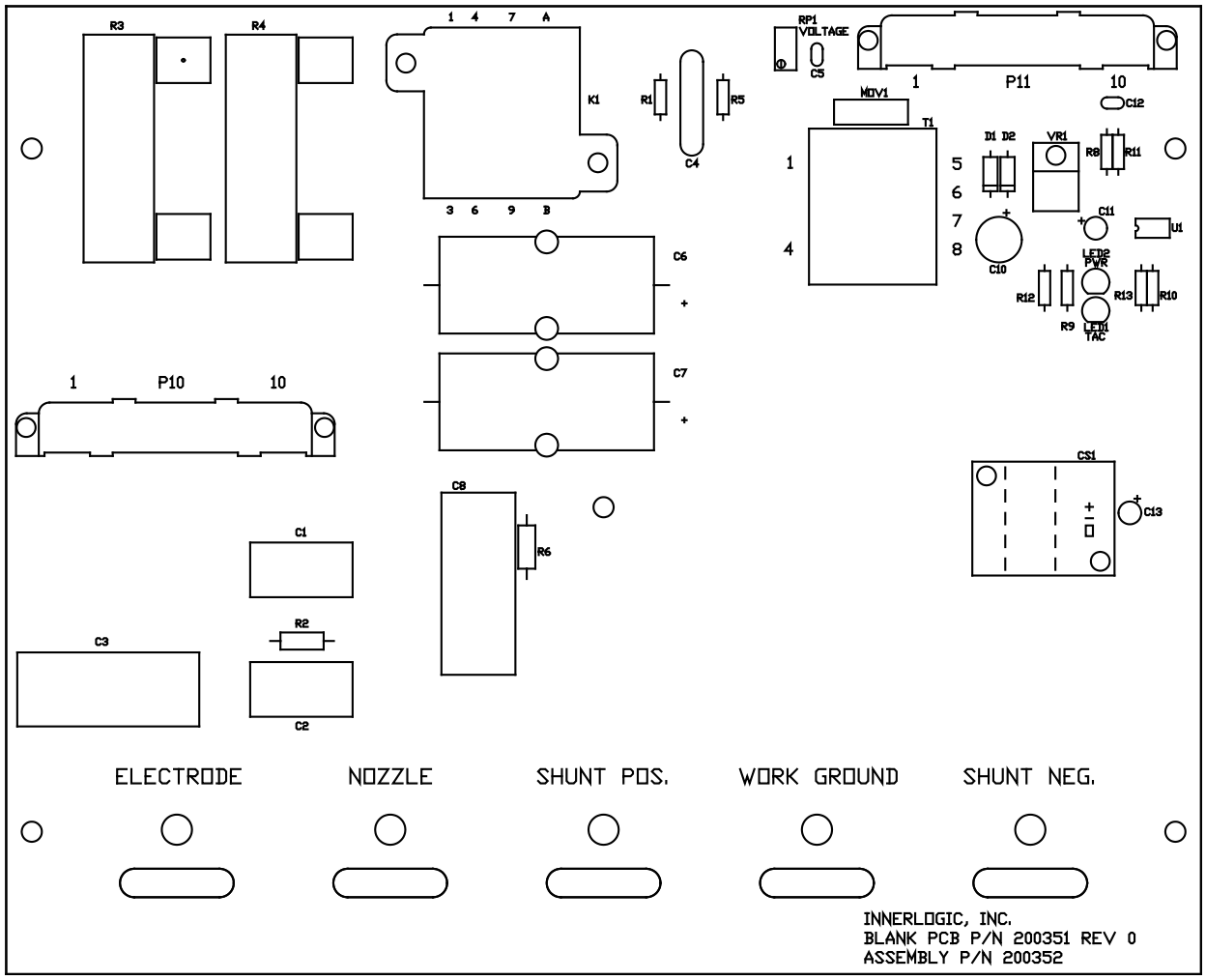


Figure 6-21 Power Supply I/O P.C. Board

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Gas Console Relay P.C. Board (Assembly 277060)

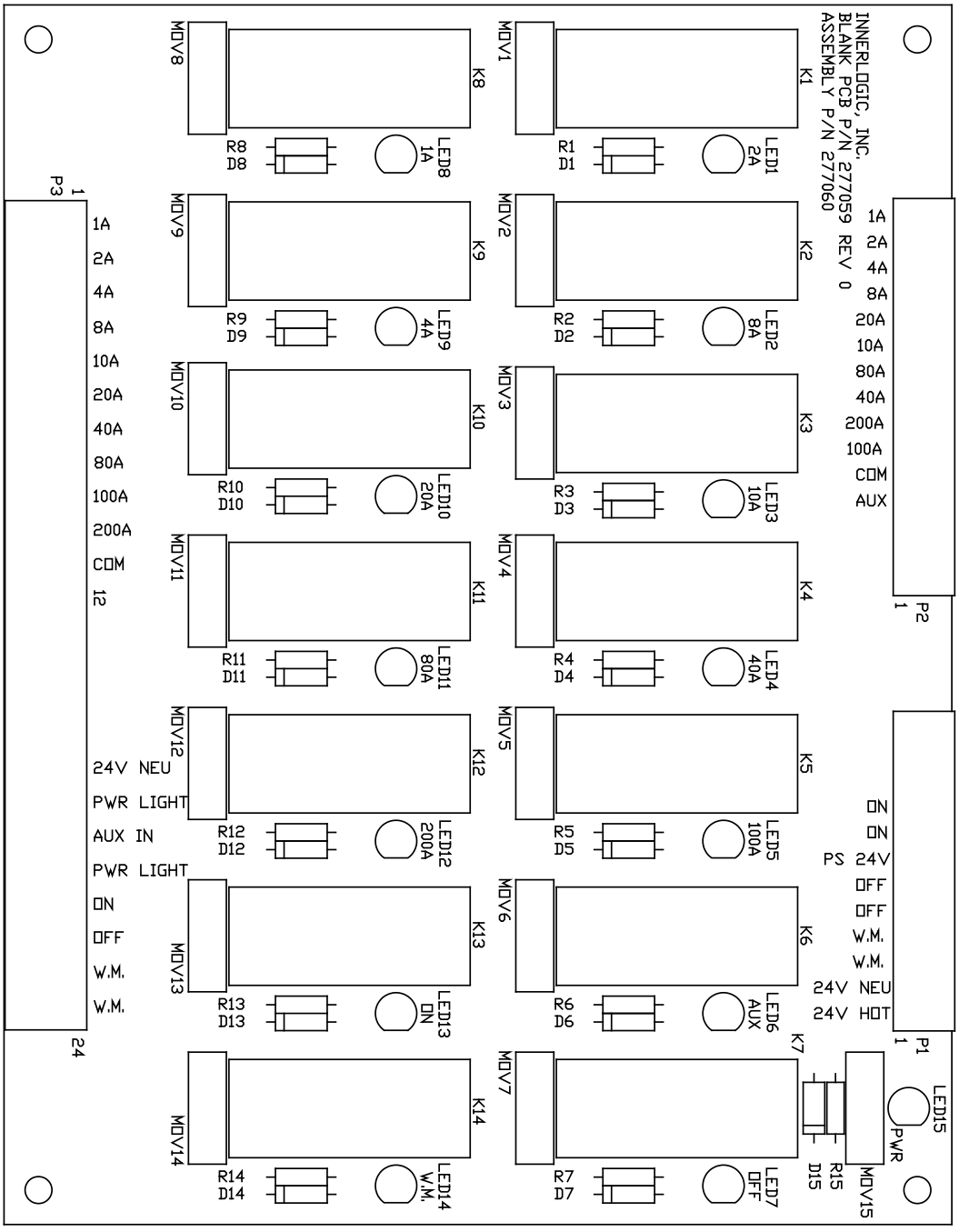


Figure 6-22 Gas Console Relay P.C. Board

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Remote On/Off Control Assembly (Optional)

Item Number	Part Number	Quantity	Description
1	708087	1	Power Off actuator, red
2	708089	1	Power On actuator, green / illuminated
3	708090	2	Power On / Off switch, green
4	740106	1	Bulb, Power On switch
Not Shown	709124	1	Receptacle, 9 pin

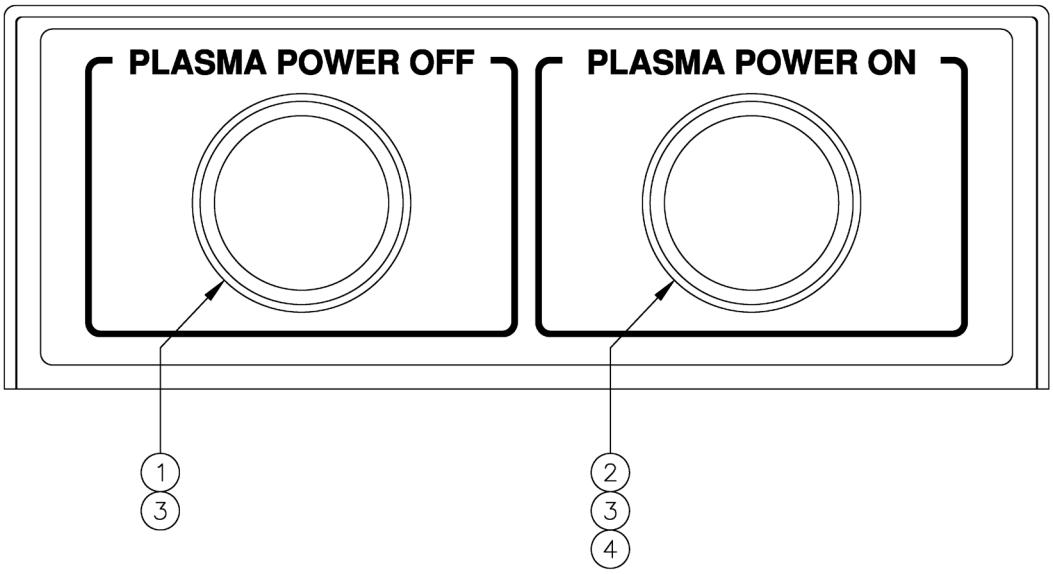


Figure 6-23 Remote On/Off Control Assembly (Optional)

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Remote On/Off Control Cable (Optional)

Part Number	Length
711800-10	10 ft. (3.0 m)
711800-15	15 ft. (4.6 m)
711800-20	20 ft. (6.1 m)
711800-25	25 ft. (7.6 m)
711800-30	30 ft. (9.1 m)
711800-35	35 ft. (10.7 m)
711800-40	40 ft. (12.2 m)
711800-45	45 ft. (13.7 m)
711800-50	50 ft. (15.2 m)
711800-55	55 ft. (16.8 m)
711800-60	60 ft. (18.3 m)
711800-65	65 ft. (19.8 m)
711800-70	70 ft. (21.3 m)
711800-75	75 ft. (22.9 m)
711800-80	80 ft. (24.4 m)
711800-85	85 ft. (25.9 m)
711800-90	90 ft. (27.4 m)
711800-95	95 ft. (29.0 m)
711800-100	100 ft. (30.5 m)

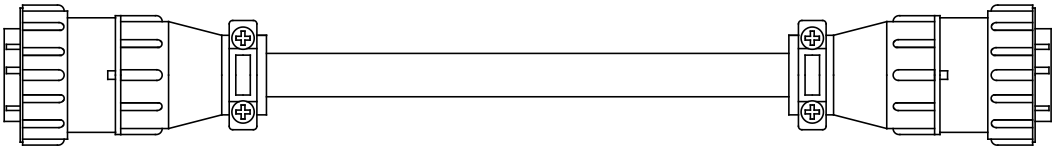


Figure 6-24 Remote On/Off Control Cable (Optional)

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Hydrogen Manifold Assembly (Optional)

Item Number	Part Number	Quantity	Description
1	708076	1	Pressure gauge – 200 psi
2	500570	1	Pressure regulator – 125 psi
3	708113	1	Pressure gauge – 160 psi
Not Shown	708097	1	Pressure switch, 80-200 psi
Not Shown	709124	1	Receptacle, 9 pin

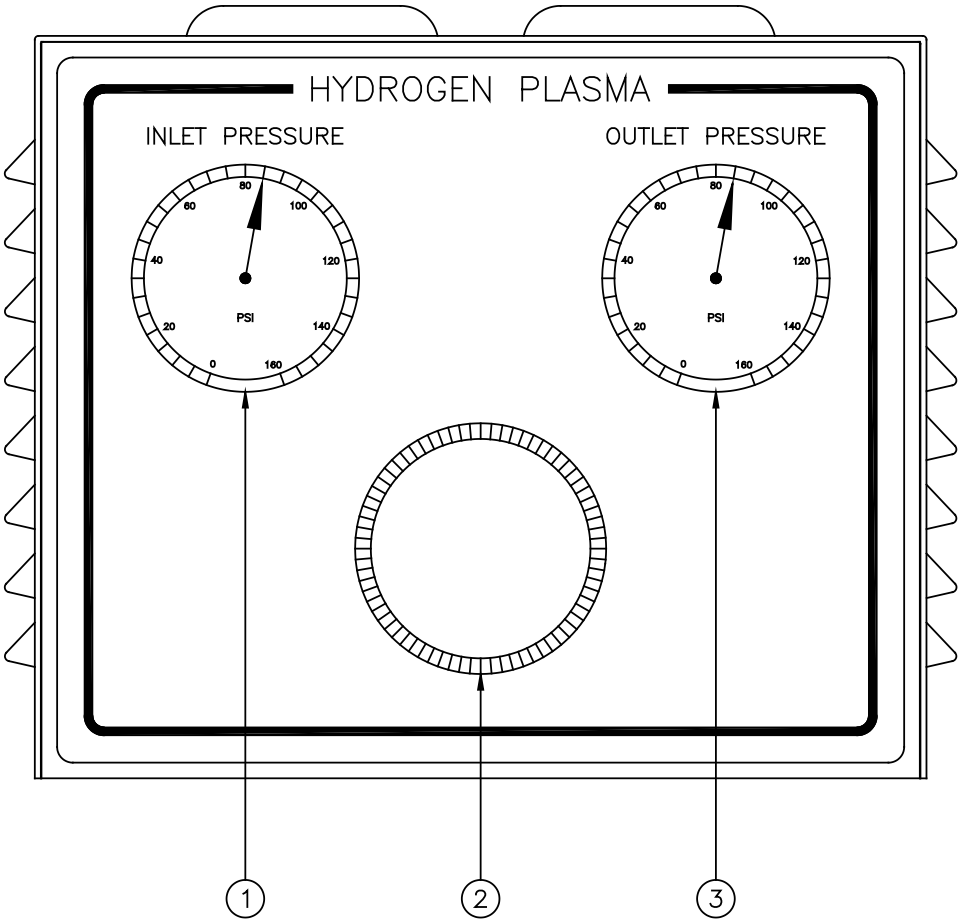


Figure 6-25 Hydrogen Manifold Assembly (Optional)

This information is subject to the controls of the Export Administration Regulations [EAR]. This information shall not be provided to non-U.S. persons or transferred by any means to any location outside the United States contrary to the requirements of the EAR.

Hydrogen Manifold Interface Cable (Optional)

Part Number	Length
277089	1.5 ft. (0.5 m)

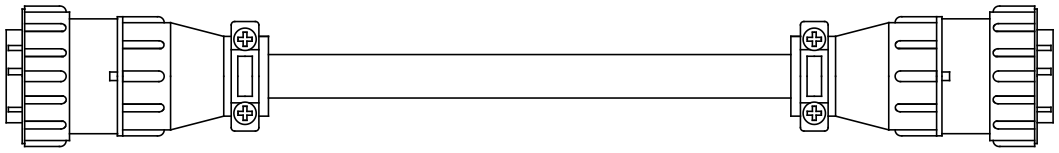


Figure 6-26 Hydrogen Manifold Interface Cable (Optional)

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Consumable Spare Parts Kit (Part Number 281267)

Part Number	Quantity	Description
277130	3	Electrode 30A Mild Steel - 30A Aluminum
277137	2	Electrode 30/50A Stainless (Air)
277131	6	Electrode 50/70A Mild Steel - 70A Stainless (Air) - 50/70A Aluminum
277132	2	Electrode 70A Stainless (H17)
277282	3	Electrode 100A Mild Steel - 100A Stainless (Air) - 100A Aluminum
277133	2	Electrode 100A Stainless (H17)
277292	3	Electrode 150A Mild Steel – 150A Stainless (Air) – 150A Aluminum
277135	2	Electrode 150A Stainless (H17)
277120	5	Nozzle 30A Mild Steel - 30A Aluminum
277121	3	Nozzle 30A Stainless (Air)
277122	5	Nozzle 50A Mild Steel - 50A Aluminum
277123	3	Nozzle 50A Stainless (Air)
277125	5	Nozzle 70A Mild Steel - 70A Stainless (Air) - 70A Aluminum
277124	3	Nozzle 70A Stainless (H17)
277284	5	Nozzle 100A Mild Steel – 100A Stainless (Air) - 100A Aluminum
277126	3	Nozzle 100A Stainless (H17)
277293	5	Nozzle 150A Mild Steel – 150A Stainless (Air) – 150A Aluminum
277297	3	Nozzle 150A Stainless (H17)
277145	3	Shield Cap 30A Mild Steel - 30A Aluminum
277144	3	Shield Cap 30A Stainless (Air)

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Part Number	Quantity	Description
277149	3	Shield Cap 50A Stainless (Air)
277115	3	Shield Cap 50A Mild Steel
277150	3	Shield Cap 70A Mild Steel - 70A Stainless - 50/70A Aluminum
277286	3	Shield Cap 100A Mild Steel - 100A Stainless (Air) - 100A Aluminum
277146	3	Shield Cap 100A Stainless (H17)
277117	3	Shield Cap 150A Mild Steel – 150A Stainless (Air) – 150A Aluminum
277298	3	Shield Cap 150A Stainless (H17)
277138	1	Swirl Ring 30A Stainless (Air)
277140	1	Swirl Ring 30/50A Mild Steel - 70A Stainless (H17) - 30A Aluminum
277142	1	Swirl Ring 50/70A Mild Steel - 50/70A Stainless (Air) - 50/70A Aluminum
277283	1	Swirl Ring 100A Mild Steel – 100A Stainless (Air) – 100A Aluminum
277141	1	Swirl Ring 100A Stainless (H17)
277139	1	Swirl Ring 150A Mild Steel – 150A Stainless – 150A Aluminum
277110	1	Inner Retaining Cap 30/50A Stainless (Air)
277153	1	Inner Retaining Cap 30/50/70A Mild Steel - 70A Stainless (Air) 30/50/70A Aluminum
277151	1	Inner Retaining Cap 100A Mild Steel - 100A Stainless (Air) - 100A Aluminum 150A Mild Steel – 1/2" and below
277152	1	Inner Retaining Cap 150A Mild Steel – 5/8" and above – 150A Stainless (Air) 150A Aluminum
277113	1	Inner Retaining Cap 70/100A Stainless (H17)
277266	1	Inner Retaining Cap 150A Stainless (H17)
716012	1	O-ring Lubricant
500024	2	Torch O-ring – blue, lower
500018	2	Torch O-ring – red, middle
820209	2	Torch O-ring – black, upper

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Part Number	Quantity	Description
277056	1	Nozzle Removal Tool
277086	1	Electrode Removal Tool Driver
277087	1	Electrode Removal Tool Socket
260105	1	Swirl Ring Removal Tool
277154	1	Outer Retaining Cap

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Appendix A Electromagnetic Compatibility (EMC)

Background

The 380V 50/60Hz and 415V 50/60Hz CE marked ProLine 2150 plasma cutting systems are manufactured to comply with the European standard EN 60974-10 (Electromagnetic compatibility (EMC) – Product standard for arc welding equipment). The system has been tested in accordance with CISPR 11, EMC classification- Group 2 ISM (Class A). The limits used in this standard are based on practical experience. However, the ability of plasma cutting equipment to work in a compatible manner with other radio and electronic systems is greatly influenced by the manner in which it is installed and used. For this reason, it is important that the plasma cutting equipment be installed and used in accordance with the information below if electromagnetic compatibility is to be achieved.

Plasma cutting equipment is primarily intended for use in an industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments.

Installation and Use

The user is responsible for installing and using the plasma cutting equipment according to the manufacturer's instructions. If electromagnetic disturbances are detected then it shall be the responsibility of the user of the plasma cutting equipment to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing the plasma cutting circuit, see Note. In other cases it could involve constructing an electromagnetic screen enclosing the plasma power source and the work, complete with associated input filters. In all cases, electromagnetic disturbances shall be reduced to the point where they are no longer troublesome.

Note: The plasma cutting circuit may or may not be earthed for safety reasons. Changing the earthing arrangements should only be authorized by a person who is competent to assess whether the changes will increase the risk of injury, e.g. by allowing parallel plasma cutting current return paths which may damage the earth circuits of other equipment. Further guidance is given in IEC 974-13 *Arc welding equipment – Installation and use.*

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Assessment of Area

Before installing plasma cutting equipment, the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

a) other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the plasma cutting equipment;
b) radio and television transmitters and receivers;
c) computer and other control equipment;
d) safety critical equipment, e.g. guarding of industrial equipment;
e) the health of the people around, e.g. the use of pacemakers and hearing aids;
f) equipment used for calibration or measurement;
g) the immunity of other equipment in the environment; the user shall ensure that other equipment being used in the environment is compatible; this may require additional protection measures;
h) the time of day that plasma cutting or other activities are to be carried out.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

Methods of Reducing Emissions

Mains Supply
Plasma cutting equipment should be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply. Consideration should be given to shielding the supply cable of permanently installed plasma cutting equipment in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the plasma power source so that good electrical contact is maintained between the conduit and the plasma power source enclosure.

Maintenance of the Plasma Cutting Equipment
The plasma cutting equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the plasma cutting equipment is in operation. The plasma cutting equipment should not be modified in any way except for those changes and adjustments covered in the manufacturer's instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

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Plasma Cutting Cables
The plasma cutting cables should be kept as short as possible and should be positioned close together, running at or close to the floor level.

Equipotential Bonding
Bonding of all metallic components in the plasma cutting installation and adjacent to it should be considered. However, metallic components bonded to the workpiece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of the Workpiece
Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, e.g. ship's hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

Screening and Shielding
Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding installation may be considered for special applications.

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